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1981

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

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FOREWORD

The *Summary of Operations, 1981, Mineral Resources Division* provides a review of the mineral industry, detailed statistics of its performance and a summary of the activities of the Mineral Resources Division in 1981. These three elements, review, statistics and operations of the Division, form three chapters that follow the format of equivalent chapters in the Annual Report of the Minister in 1979. The creation of a volume, Summary of Operations, parallels the practice in the Petroleum Division and it is intended to eventually get the data of the industry to the interested public in a more timely manner while leaving the Annual Report of the Minister free of details and statistics.

The evolution of yearly reports continues as the growth and diversification of industry related to mineral and fuel resources diversifies and as the Ministry reacts. Annual Reports of the Minister of Mines have been published from 1874. Changes in name of the Ministry occurred in 1959 to Mines and Petroleum Resources and in 1978 to Energy, Mines and Petroleum Resources. In addition in 1969 geological and technical reports previously published as part of the Annual Report were published separately as *Geology, Exploration and Mining in British Columbia*. Starting in 1975, this technical volume has been divided into separate reports that are issued as they are prepared. Detailed information on mine safety, fatal accidents, dangerous occurrences, etc., was included in the Annual Report until 1973, for 1974 was issued separately, and subsequently forms part of the separate volume *Mining in British Columbia*.

The Mineral Industry in 1981

CHAPTER 1

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INTRODUCTION

The mineral industry in its broadest context includes all primary industry based on geological or subsurface resources. This introduction reviews this broad aspect to relate the metallic, non-metallic, coal and petroleum based industries before being concerned only with the solid minerals that are mined.

The value of mineral production in British Columbia totalled $3 009 million during 1981, representing a slight decrease of 2.2 per cent from the record high level of $3 077 million in 1980. Much of the decrease was due to the lower prices received for many products since the production of many minerals was up, particularly metallic minerals. Coal posted the largest gain amongst all commodities. The bright spots in metals were iron concentrates and, particularly, zinc which increased in both production and prices over the 1980 levels.

The 10 most valuable commodities in 1981 in decreasing order were natural gas, copper, coal, crude oil, molybdenum, silver, lode gold, sand and gravel, cement and asbestos. The value of natural gas resumed its first position in 1981 after being surpassed by copper in 1980. Coal remained the third most valuable mineral product after natural gas and copper. The top 10 commodities in 1981 were the same as those in 1980 with some changes in relative ranking among the 10 commodities. Lead, which ranked ninth in 1979, dropped outside of the top 10 group in 1980 and has not regained its position since. British Columbia continued to be Canada's leading producer of copper, molybdenum, lead, and coal, and a major contributor to Canada's producton of natural gas, zinc, asbestos, cement, gold and silver. Details of mineral production for 1981 are shown in Table 1-1 with comparisons to 1980. A diagram is presented in Figure 1-1 illustrating the production in 1981.

In the solid mineral industry both metals and structural materials exhibited declines in production values. Coal showed a promising gain of over 20 per cent during the year and industrial minerals enjoyed a moderate increase of 5.6 per cent over the 1980 level. The metals sector accounted for most of the decrease during the period. Of the top 10 commodities, all but crude oil experienced a decline in the value of production during 1981. The total value and percentage change for the various sectors are as follows:

	1981 Value $	Change Per cent
Metals	1 246 682 535	−12.8
Petroleum and Natural Gas	884 561 084	+6.8
Coal	554 271 292	+20.1
Structural Materials	200 786 279	−17.1
Industrial Minerals	122 464 842	+5.6

The growth of the mineral industry and the changing proportion contributed by the various sectors are illustrated by two diagrams. Figure 1-2 shows growth in total value in actual dollars and in deflated dollars. Figure 1-3 shows the relative proportion contributed by the various sectors. In both diagrams these trends are shown in five-year increments to 1970 and yearly thereafter. Comparisons of the figures reveal major shifts in trends and demonstrate growth of specific commodity sectors. The important changes illustrated are as follows:

(1) The dominance of metals continued but their importance declined as the share of metals in the total mineral production decreased by over 10.0 per cent in 1981.

(2) Increased energy demand worldwide has led to increases in the production of energy-related minerals in British Columbia.

Table 1-1 — Mineral Production of British Columbia, 1980 and 1981

		1980		1981	
		Quantity	Value	Quantity	Value
Metals	Units		$		$
Antimony	kg	78 654	416 080	68 323	360 745
Bismuth	kg	23 501	136 306	47 300	102 641
Cadmium	kg	92 360	560 679	101 962	371 077
Copper	kg	264 674 830	670 623 616	290 088 241	611 282 050
Gold—placer	g	280 104	6 213 376	291 705	4 540 289
Gold—lode, fine	g	7 197 312	163 930 073	7 468 769	131 542 422
Iron concentrates	t	653 324	13 670 233	602 272	14 274 498
Lead	kg	76 709 447	66 096 223	84 854 093	61 529 276
Molybdenum	kg	11 209 501	288 934 398	12 933 244	198 240 391
Silver	g	203 801 811	156 548 306	403 754 797	152 420 716
Tin	kg	139 517	2 438 881	150 341	2 198 138
Zinc	kg	67 481 328	49 363 417	79 214 552	67 026 535
Others		....	10 070 592	....	2 793 757
Subtotals		....	1 429 002 180	....	1 246 682 535
Industrial Minerals					
Asbestos	t	100 089	81 688 936	90 914	76 770 285
Diatomite	t	3 615	138 273	3 600	155 232
Fluxes (quartz, limestone)	t	43 986	93 135	48 313	509 678
Granules (quartz, limestone, granite)	t	31 393	1 694 947	28 297	1 756 810
Gypsum and gypsite	t	751 067	5 387 949	684 924	5 804 770
Jade	kg	449 156	1 580 241	59 208	133 598
Sulphur	t	359 413	21 712 359	507 566	33 337 562
Others		....	3 630 167	....	8 996 307
Subtotals		....	115 926 007	....	122 464 842
Structural Materials					
Cement	t	1 351 320	90 881 086	955 922	82 372 375
Clay products		....	10 387 121	....	10 292 772
Lime and limestone	t	3 129 762	9 945 044	2 659 406	9 400 205
Rubble, riprap and crushed rock	t	7 019 167	32 436 456	3 168 694	11 100 383
Sand and gravel	t	45 278 202	98 666 100	42 361 930	87 603 864
Building stone	t	91	9 850	383	16 680
Subtotals		....	242 325 657	....	200 786 279
Coal					
Sold and used	t	10 823 530	461 492 857	11 752 621	554 271 292
Total solid minerals		....	2 248 746 701	....	2 124 204 948
Petroleum and Natural Gas					
Crude oil	m^3	2 002 128	189 561 479	2 035 953	236 170 548
Field condensate	m^3	36 885	3 489 431	27 871	3 233 036
Plant condensate	m^3	133 601	11 641 991	124 946	13 284 259
Natural gas delivered to pipeline	10^3m^3	8 931 833	612 545 107	8 062 681	616 795 096
Butane	m^3	89 556	6 491 914	84 635	9 953 076
Propane	m^3	75 507	4 572 704	64 118	5 080 069
Total petroleum and natural gas		....	828 302 626	....	884 516 084
Grand totals		....	3 077 049 327	....	3 008 721 032

CONVERSION TABLE

Metric **Symbol**
Tonnes .... t + .90718=short tons.
Kilograms .... kg ÷ .45359=pounds.
Grams .... g ÷ 31.103=troy ounces.
Cubic metres .... m^3 × 6.29=barrels.
Thousand cubic metres .... 10^3m^3 × 35.49373=thousand standard cubic feet.

(3) Coal and crude oil registered the most impressive gains in the values of production, each showing an increase of over 20 per cent in 1981. These increases were attributed largely to growth in export markets.

(4) Among the top 10 commodities in 1981, average unit price went up for natural gas, coal, crude oil, cement and asbestos while unit price for copper, molybdenum, silver, gold and sand and gravel were actually lower than the 1980 levels. Sharpest declines in average unit price were experienced by silver and molybdenum.

(5) Rapid growth of petroleum and natural gas which started in the 1950s and 1960s appears to be continuing.

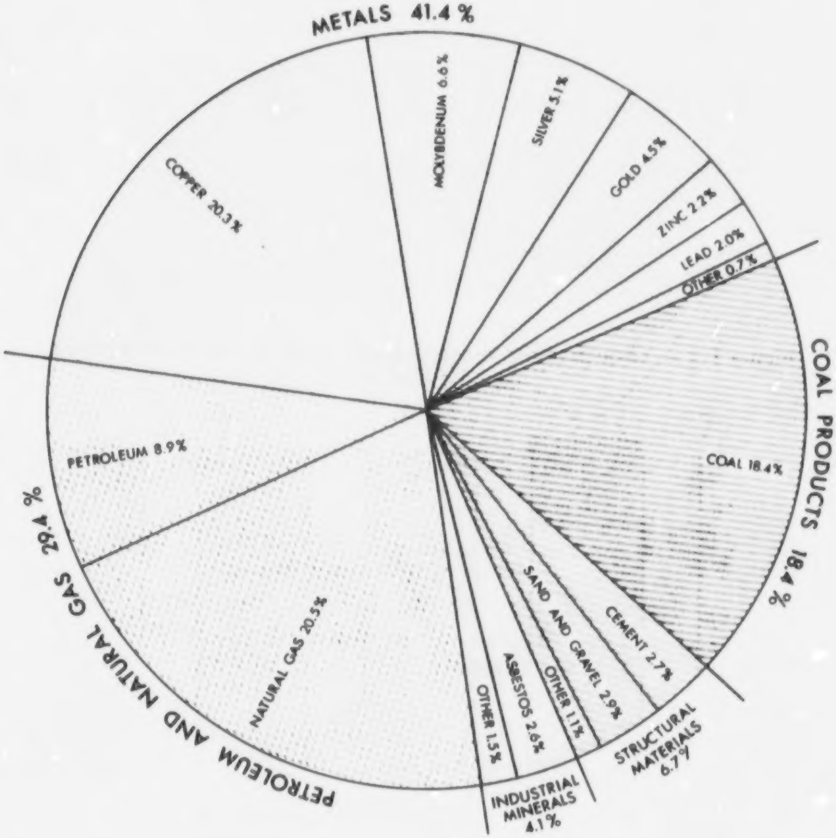


Figure 1-1 — Major mineral commodities produced in 1981 by value.

The value of the production of the various sectors is shown throughout their history of production on a log graph, Figure 3-1.

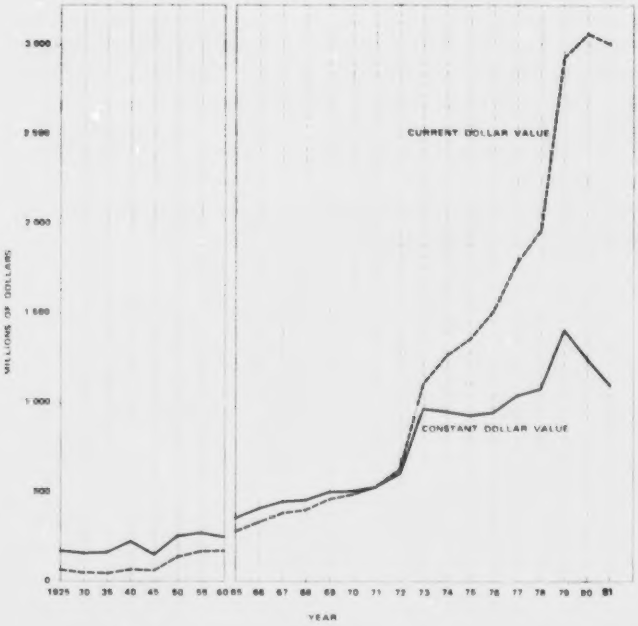


Figure 1-2 — Growth of the mineral industry in total value in actual dollars and deflated dollars.

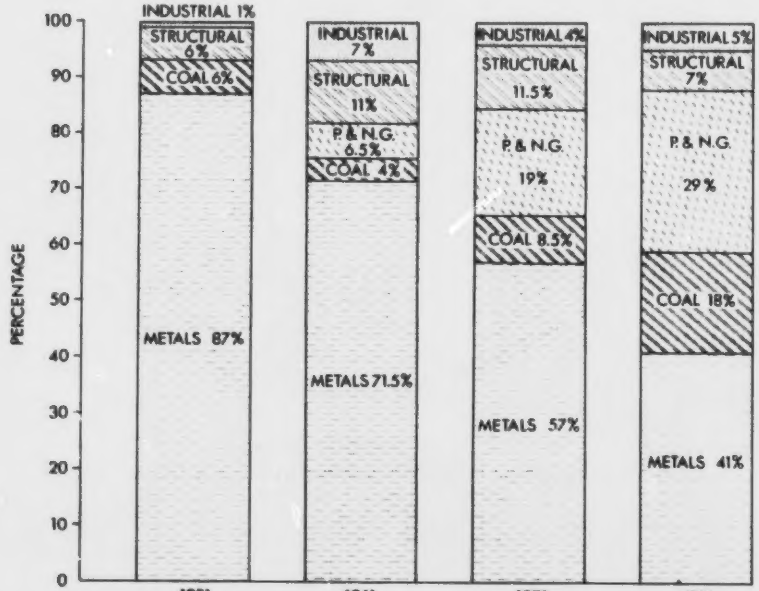


Figure 1-3 — Percentage value of mineral industry sectors.

REVENUE TO THE CROWN

Direct revenue to the provincial government in 1981 from the mining and petroleum industries is shown on Figure 1-4.

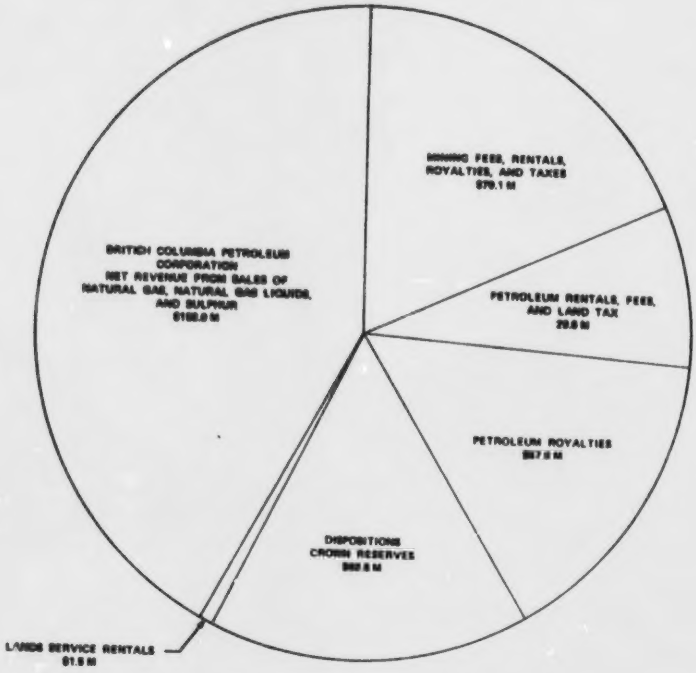
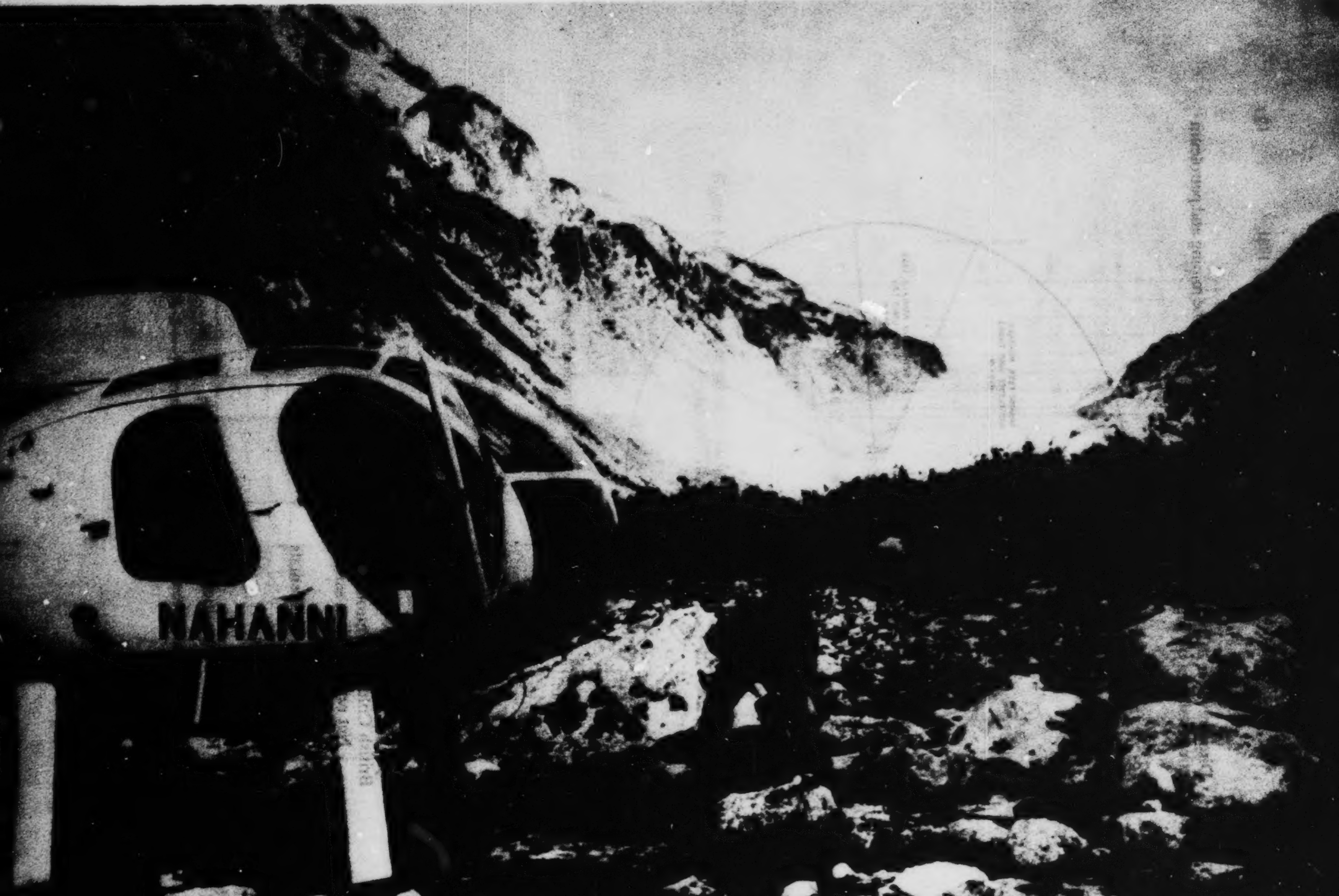


Figure 1-4 — Direct revenue to the provincial government from the mineral and petroleum industries, 1981.

Table 1-2 — Direct Revenue to the Provincial Government from the Petroleum and Mineral Industries, 1981

	$
Petroleum Industry—	
Crown reserves—disposition	60 776 966
Rental and fees	27 334 015
Crown royalties	57 038 394
British Columbia Petroleum Corporation—	
Net revenue from sales	158 000 000
Mining Industry—	
Claims, fees, and rentals	4 860 320
Royalties	6 036 114
Mineral taxes	58 900 579
Lands Service—	
Rentals and royalties on structural materials	1 492 600
Total	374 438 988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THE MINING INDUSTRY IN 1981

The total value of solid minerals was $2 124.2 million in 1981, a decline of $124.5 million from the previous year's production of $2 248.7 million. This decline in value is attributable to decreasing metal prices throughout the year; production increases, while substantial in the case of silver and molybdenum, were insufficient to maintain value of output at 1980 levels. Within the solid mineral sector, metals accounted for 58.7 per cent; coal for 26.0 per cent; structural materials for 9.5 per cent; and industrial minerals accounted for the remaining 5.8 per cent of total value.

METALS

The quantities of major metals produced over time are illustrated on the log-graph Figure 1-5.

Lead and zinc production advanced sharply in the period 1920 to 1943, thereafter starting a slow decline, a feature dependent principally on the production history of the Sullivan mine. In contrast, copper production remained at a modest level until the onset of major porphyry copper production in the late sixties. Molybdenum production also started its growth in this period, related principally to mining of porphyry deposits. The history of precious metals has, since the peak of production for gold in 1939 and for silver in 1940, been increasingly related to by-product production from massive sulphide and porphyry deposits. However the recent sharp rise in precious metal prices has encouraged the opening of new gold and silver mines.

The value of total metal production in 1981 was $1 24[illegible]7 million, as compared to $1 429.0 million in the previous year. Copper production increased by 9.6 per cent to 290 088 tonnes, reflecting new production from the Highmont and Granduc mines and expanded production at the Lornex mine. Average annual prices declined from $2.53/kg in 1980 to $2.11/kg in 1981, resulting in a gross value of copper of $611.3 million in the latter year as opposed to $670.6 million in 1980. Despite this decline copper remained by far the most important commodity in the mineral sector, representing 49.0 per cent of the value of metals and 28.8 per cent of solid minerals produced.

Molybdenum production in 1981 increased by 15.7 per cent to 12 933 tonnes; however drastic reductions in prices from $25.85/kg in 1980 to $15.33/kg in 1981 resulted in a decline of 31 per cent in value of production to $198.2 million in 1981.

Zinc production increased from 67 481 tonnes to 79 214 tonnes, and since average prices increased from 73¢/kg in 1980 to 85¢/kg in 1981, total value of zinc production increased by almost 36 per cent to $67 million.

Production of lead increased by 8 145 tonnes to 84 854 tonnes. The price decline of 13¢/kg to an average price of 73¢/kg in 1981 resulted in a decline in value from $66.1 million to $61.5 million.

Silver production set a historical annual record of 403.7 million grams due to both the opening of the Equity Silver (Sam Goosly) mine and increased output as by-product resulting from increased copper, lead and zinc production. The metal's price performance was very disappointing however, decreasing from 76.8¢/gram in 1980 to 37.7¢/gram in 1981. This resulted in an actual decrease of $4.1 million to $152.4 million in the 1981 gross value.

Similarly gold, while increasing production from 7.5 million grams to 7.8 million grams, in 1981 decreased in value from $170.1 million to $136.1 million as a result of a decline in price from $22.75/gram in 1980 to $17.54/gram in 1981.

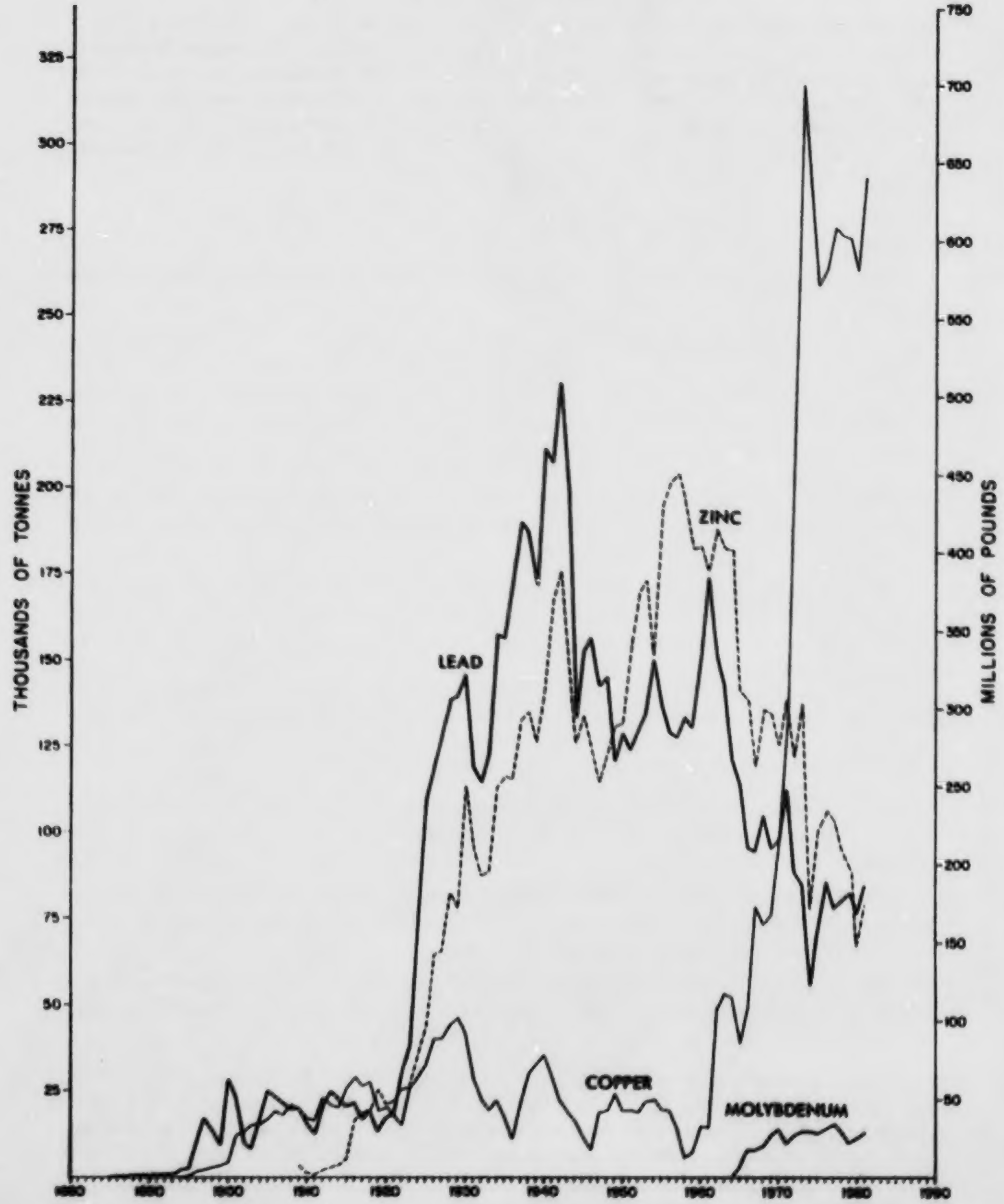


Figure 1-5—Quantities of major metals produced, 1885–1981.

Iron concentrate production was down by 8 per cent to 602 272 tonnes; however a price increase from $20.92/tonne to $23.70 brought the 1981 value of production up to $14.3 million from $13.7 million in 1980.

Among the minor metals, antimony, bismuth, cadmium and tin values were all lower than in 1980: tin production increased marginally.

COAL

Coal shipments in 1981 increased by 930 000 tonnes to 11 752 621 tonnes. The average minehead price per tonne increased by $4.52 to $47.16, resulting in a value of production of $554 million. Coal therefore remained the third most important mineral commodity produced in British Columbia after natural gas and copper.

INDUSTRIAL MINERALS

Production of asbestos declined from 100 089 tonnes, valued at $81.7 million ($816.16 per tonne) in 1980, to 90 914 tonnes, valued at $76.8 million ($844.43 per tonne). Sulphur production and value increased to 507 566 tonnes and $33.3 million respectively, from 359 413 tonnes valued at $21.7 million; price per tonne therefore increased from $60.41 to $65.68. Total production value of all industrial minerals increased by 5.6 per cent to $122.5 million.

STRUCTURAL MATERIALS

The value of structural materials produced dropped by $41.5 million in 1981 to $200.8 million. Cement production fell by almost 30 per cent to 955 922 tonnes from 1 351 320 tonnes in the previous year. The value of cement production also fell from $90.9 million to $82.4 million, a decrease of 9.4 per cent, indicating an actual increase in the per tonne value from $67.25 to $85.28. The decrease in production but the accompanying increase in unit value was a result of a strike in the cement industry.

PROVINCIAL REVENUE FROM MINING COMPANIES

Direct revenue to the provincial government derived from the mining sector of the mineral industry in 1981 is shown in Table 1-3. The total revenue amounted to about $73.7 million. Provincial mining tax, mineral resource and mineral land taxes accounted for about 80.0 per cent of total provincial mineral revenue. The remaining revenue was mainly attributable to mineral claims, fees, rentals and coal royalties.

For coal licences and rentals, the amount shown below includes cash paid in lieu of work, some of which may be refundable. The rentals and royalties on industrial minerals and structural materials were collected by the Ministry of Lands, Parks and Housing.

Table 1-3 — Revenue from Mineral Resources, 1981

	$
Claims	4 178 169
Coal licence fees and rentals collected	3 128 752
Coal royalties	6 011 820
Iron ore royalties	24 295
Mineral land taxes	10 999 205
Mineral resource taxes	32 153 394
Mining taxes	15 747 983
Rental and royalties on industrial minerals and structural materials	1 492 601
Total	73 736 219

EXPENDITURES BY MINING COMPANIES

Major expenditures in 1981 by mining companies involved in exploration, development, and mining of metals, minerals, and coal are shown in Table 1-4.

Table 1-4 — Expenditures, Mining Companies, 1981

	$	$
Capital expenditures	680 866 586	
Exploration and development	313 256 857	994 123 443
Mining operations (metals, minerals, coal)		894 032 706
Mining operations (structural materials)		42 662 569
Repair expenditures		297 014 173
Total		2 227 832 891

Comparable data for 1980 is given in Table 1-5 below:

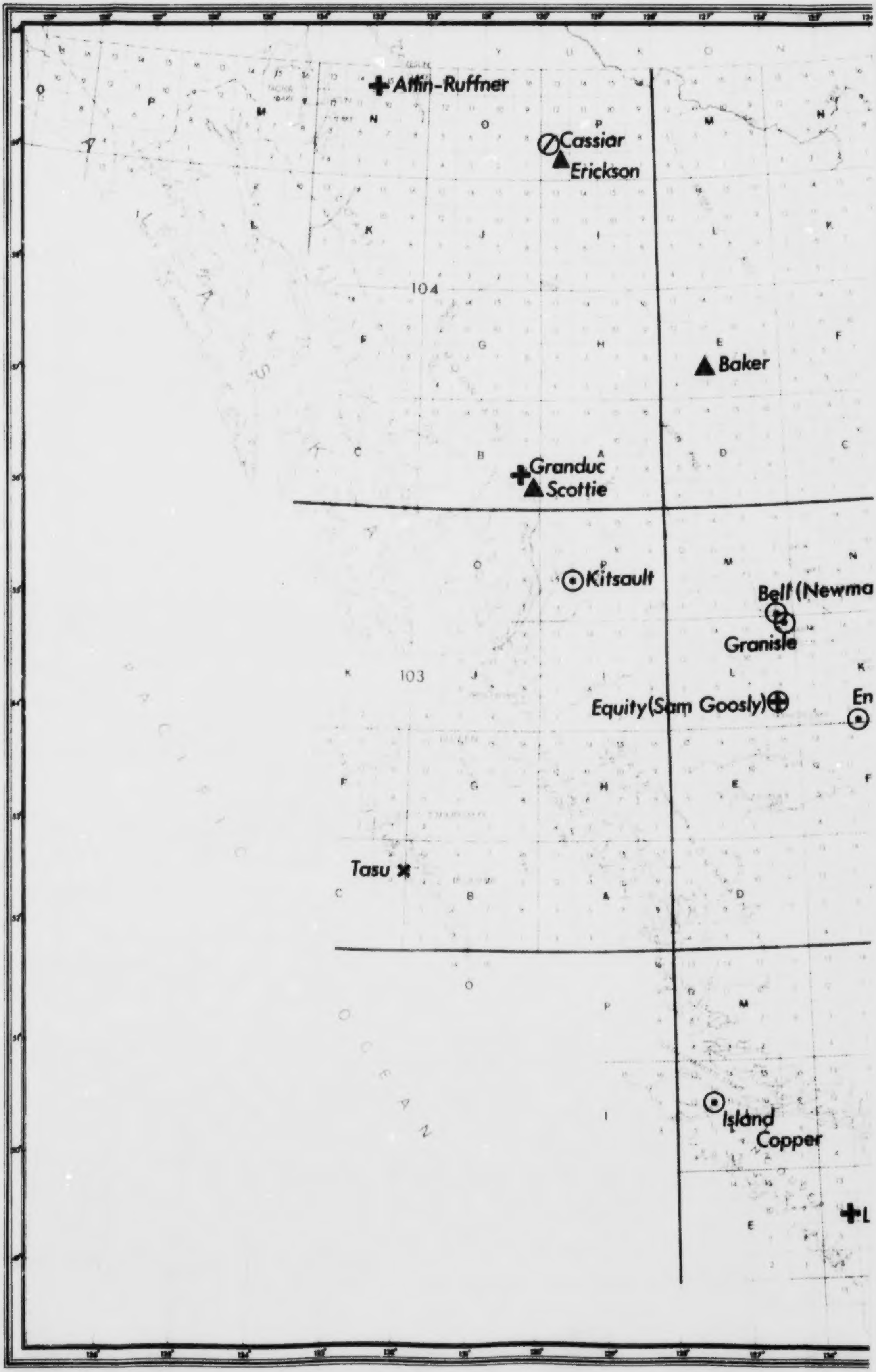
Table 1-5 — Expenditures, Mining Companies, 1980

	$	$
Capital expenditures	395 817 815	
Exploration and development	346 290 323	742 108 138
Mining operations (metals, minerals, coal)		652 230 225
Mining operations (structural materials)		66 771 452
Repair expenditures		252 156 755
Total		1 713 266 570

Figure 1-6—Mines in British Columbia Which Produced More Than 1 000 Tonnes of Ore in 1981

Name of Mine	Products	NTS	Mill Capacity TM/day	Mine[1] Type	Company Name	Company Address	Mine Address/Area
Afton	Cu, Ag, Au	92I/09W	9 000	O	Afton Mines Ltd.	1119 West Hastings St., Vancouver, B.C. V6E 2K2	Box 937, Kamloops, B.C. V2C 5N4
Atlin-Ruffner	Ag, Pb, Zn, Au	104N/12E	125	U	Trident Resources Inc	107, 325 Howe St., Vancouver, B.C. V6C 1Z7	Atlin, B.C.
Baker (Chappelle)	Au, Ag	94E/06E	100	U	DuPont of Canada Expl. Ltd.	102, 1550 Alberni St., Vancouver, B.C. V6C 1A5	Toodoggone, B.C.
Bell (Newman)	Cu, Ag, Au	93M/01E	17 000	O	Noranda Mines Ltd.	1500, 1066 West Hastings St., Vancouver, B.C. V6C 3X1	Box 1000, Granisle, B.C. V0J 1W0
Bethlehem	Cu, Ag, Au, Mo	92I/07W	20 000	O	Bethlehem Copper Corp.	2100, 1055 West Hastings St., Vancouver, B.C. V6C 2H8	Box 520, Ashcroft, B.C. V0K 1A0
Boss Mountain	Mo	93A/02W	3 000	O/U	Noranda Mines Ltd.	1500, 1066 West Hastings St., Vancouver, B.C. V6C 3X1	Hendrix Lake, B.C. V0K 1RO
Brenda	Cu, Mo, Ag, Au	92H/16E	30 000	O	Brenda Mines Ltd.	Box 420, Peachland, B.C. V0H 1X0	Box 420, Peachland, B.C. V0H 1X0
Craigmont	Cu, Fe	92I/02W	5 000	U	Craigmont Mines Ltd.	700, 1030 West Georgia St., Vancouver, B.C. V6E 3A8	Box 3000, Merritt, B.C. V0K 2B0
Endako	Mo	93K/03W	36 000	O	Placer Development Ltd.	700, 1030 West Georgia St., Vancouver, B.C. V6E 3A8	Endako, B.C. V0J 1L0
Equity (Sam Goosly)	Ag, Cu, Au	93L/01W	5 000	O	Equity Silver Mines Ltd.	700, 1030 West Georgia St., Vancouver, B.C. V6E 3A8	Box 1450, Houston, B.C. V0J 1Z0
Erickson	Au	104P/04E	300	U	Erickson Gold Mining Corp.	203, 1209 East Fourth St., North Vancouver, B.C. V7J 1G8	Cassiar, B.C. V0C 1E0
Gibraltar	Mo, Cu, Ag	93B/09W	41 000	O	Gibraltar Mines Ltd.	700, 1030 West Georgia St., Vancouver, B.C. V6E 3A8	Box 130, McLeese Lake, B.C. V0L 1R0
Granduc	Cu, Ag, Au	104B/01W	4 000	U	Canada Wide Mines Ltd.	600, 1281 West Georgia St., Vancouver, B.C. V6E 3J7	Box 190, Stewart, B.C. V0T 1W0
Granisle	Cu, Mo, Ag, Au, Cd	93L/16E	14 000	O	Noranda Mines Ltd.	1500, 1066 West Hastings St., Vancouver, B.C. V6E 3X1	Box 1000, Granisle, B.C. V0J 1W0
Highland Bell	Ag, Au, Pb, Zn, Cd, Cu	82E/06E	130	U	Teck Corporation	1199 West Hastings St., Vancouver, B.C. V6C 2K5	Beaverdell, B.C. V0H 1A0
Highmont	Cu, Mo	92I/07W	25 000	O	Teck Corporation	1199 West Hastings St., Vancouver, B.C. V6C 2K5	Box 3000, Logan Lake, B.C. V0K 1W0
Horn Silver	Ag, Au, Pb, Zn	82E/04E	450	U	Dankoe Mines Ltd.	1177 West Hastings St., Vancouver, B.C. V6E 2L6	Keremeos, B.C.
Island Copper	Cu, Mo, Ag, Au	92L/11W	40 000	O	Utah Mines Ltd.	1600, 1050 West Pender St., Vancouver, B.C. V6B 3S7	Box 370, Port Hardy, B.C. V0N 2P0
Kitsault (B.C. Moly)	Mo	103P/06W	12 000	O	Amax of Canada Ltd.	1600, 1066 West Hastings St., Vancouver, B.C. V6E 3X1	Box 1000, Kitsault, B.C. V0V 1J0
Lornex	Cu, Mo, Ag	92I/06E	80 000	O	Lornex Mining Corp. Ltd.	1650, 609 Granville St., Vancouver, B.C. V7Y 1G5	Box 1500, Logan Lake, B.C. V0K 1W0
Lynx, Myra, Price	Cu, Ag, Au, Zn, Pb, Cd	92F/12E	1 000	U	Westmin Resources Ltd.	1103, 595 Burrard St., Vancouver, B.C. V7X 1C4	Box 8000, Campbell River, B.C. V9W 5E2
Mosquito Creek (Aurum)	Au, Ag	93H/4E	110	U	Mosquito Creek Gold Mining Co. Ltd.	Box 6080, Calgary, Alta. T2P 2E7	Box 10, Wells, B.C. V0K 2R0
Northair (Warman)	Au, Ag, Pb, Zn, Cu	92J/03E	300	U	Northair Mines Ltd.	1450, 625 Howe St., Vancouver, B.C. V6C 2T6	Squamish, B.C. V0N 3G0
OK, Alwin	Cu, Ag, Au	92I/06E	700	O	Panther Mines Ltd.	1897 Third Ave., Prince George, B.C. V2M 1G5	Box 699, Ashcroft, B.C. V0K 1A0
Ruth Vermont	Ag, Zn, Pb	82K/15W	350	U	Ruth Vermont Mines Ltd.	73 Water St., Vancouver, B.C. V6B 1A1	Golden, B.C. V0A 1H0
Scottie (Summit Lake)	Au, Ag	104B/01E	200	U	Scottie Gold Mines Ltd.	1450, 625 Howe St., Vancouver, B.C. V6C 2T6	Stewart, B.C. V0T 1W0
Silvana (Silmonac, Minniehaha).	Ag, Pb, Zn, Au, Cu, Fe, Cd	82F/14W	140	U	Dickenson Mines Ltd.	600, 65 Queen St. West, Toronto, Ont. M5H 2M5	Box 189, New Denver, B.C. V0G 1S0
Similkameen (Ingerbelle, Copper Mountain)	Cu, Ag, Au	92H/07E	22 000	O	Newmont Mines Ltd.	1400, 750 West Pender St., Vancouver, B.C. V6C 1K3	Box 520, Princeton, B.C. V0X 1W0
Sullivan	Pb, Zn, Ag, Sn	82F/09E	9 500	U	Cominco Ltd.	200 Granville Square, Vancouver, B.C. V6C 2R2	Box 2000, Kimberley, B.C. V1A 2G3
Tasu	Fe, Cu, Pb, Zn, Cd	103C/16E	9 500	U	Falconbridge Nickel Mines Ltd., Wesfrob Mining Div.	603, 1112 West Pender St., Vancouver, B.C. V6E 3V8	Tasu, B.C. V0T 1X0
Industrial Mineral Open Pits and Quarry							
Western Gypsum	Gypsum	82J/5W	2 450	O	Westroc Industries Ltd.	Box 5638, Postal Station A, Calgary, Alta. T2H 1Y1	Box 217, Invermere, B.C. V0A 1K0
Cassiar	Asbestos	104P/5W	3 630	O	Cassiar Asbestos Corp. Ltd.	2000, 1055 East Hastings St., Vancouver, B.C. V6E 3V3	Cassiar, B.C. V0C 1E0
Coal Mines							
Byron Creek (Corbin)	Coal	82G/10E	1 700	O	Byron Creek Collieries Ltd.	Box 270, Blairmore, Alta.	Box 270, Blairmore, Alta.
Sparwood	Coal	82G/10, 15	28 000	O/U	Kaiser Resources Ltd.	1176 West Georgia St., Vancouver, B.C. V6E 4B9	Box 2000, Sparwood
Fording (Clode Creek and Greenhill)	Coal	82J/2W	17 000	O	Fording Coal Ltd.	200, 205 Ninth Avenue SE., Calgary, Alta. T2G 0R4	Box 100, Elkford V0B 1H0

[1] O—Open pit. U—Underground.


Y U K O N
Atlin-Ruffner
Cassiar
Erickson
104
Baker
Granduc
Scottie
Kitsault
Belf (Newma
Granisle
103
Equity(Sam Goosly)
En
Tasu
Island
Copper

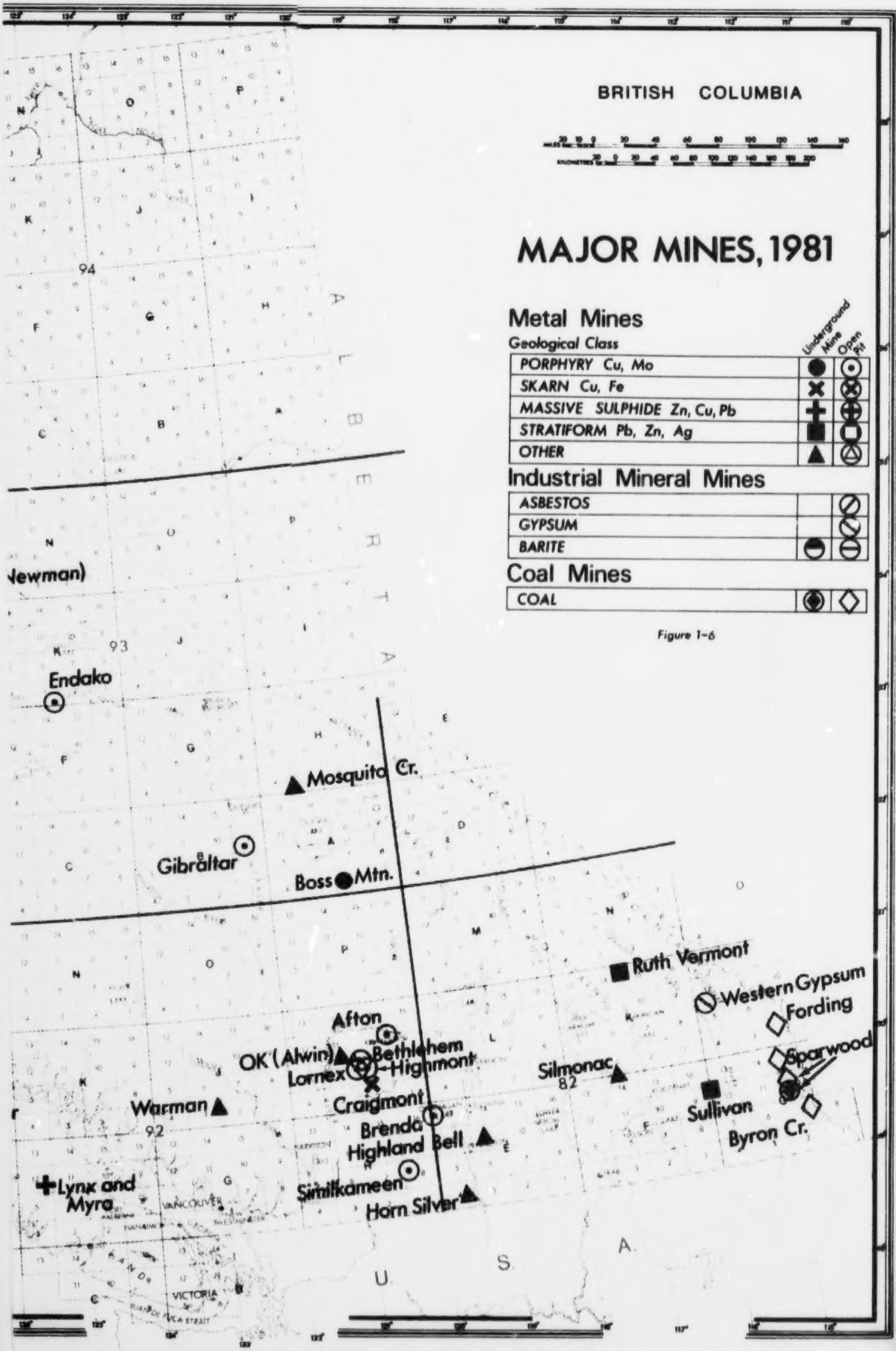

BRITISH COLUMBIA
MAJOR MINES, 1981
Metal Mines
Geological Class
Underground Mine
Open Pit
PORPHYRY Cu, Mo
SKARN Cu, Fe
MASSIVE SULPHIDE Zn, Cu, Pb
STRATIFORM Pb, Zn, Ag
OTHER
Industrial Mineral Mines
ASBESTOS
GYPSUM
BARITE
Coal Mines
COAL
94
93
92
82
Newman)
Endako
Mosquito Cr.
Gibraltar
Boss Mtn.
Ruth Vermont
Western Gypsum
Fording
Sparwood
Afton
OK (Alwin)
Bethlehem
Lornex
Highmont
Craigmont
Silmonac
Sullivan
Byron Cr.
Warman
Brenda
Highland Bell
Similkameen
Horn Silver
Lynx and Myra
VANCOUVER
VICTORIA
U. S. A.

Figure 1-6

MINING AND TREATMENT

METAL MINES

The dollar value of metals produced in 1981 fell by 13 per cent to $1 246.7 million. This amount represented shipments of 110 320 000 tonnes of ore which was concentrated or shipped to smelters (*see* Tables 3-12 and 3-13) by 62 mines, as compared with 93 433 000 tonnes shipped by 62 mines in the previous year. Thus production of ore in 1981 increased by 18.1 per cent over the 1980 level. Of the 62 mines, 30 produced more than 1 000 tonnes and are shown on Figure 1-6, classified as to product, geological type and whether open pit or underground.

Some 90 per cent of total metals were produced by 16 mines with production capacities of 1 000 000 tonnes per year. Thirteen of the largest open-pit mines operating in 1981 were, in order of output: Lornex, Island Copper, Gibraltar, Endako, Brenda, Similkameen, Bethlehem, Highmont, Bell, Granisle, Afton, Equity and Kitsault. Three other mines, Sullivan, Craigmont and Tasu, produced from underground deposits.

There were four intermediate mines which produced between 100 000 and 1 000 000 tonnes in this province during 1981, mainly from underground operations. These include the Lynx and Myra lead-zinc-copper mine, Granduc copper mine, Boss Mountain molybdenum mine, and the OK (Alwin) copper mine which ceased operation in late 1981. The aggregate tonnage of ore treated or shipped by the four intermediate mines was 1 435 215 tonnes, representing 1.3 per cent of the total.

Ten small mines operated in 1981, treating or shipping between 100 000 and 1 000 tonnes of ore each. These are underground operations and all produced gold and silver either as primary products or as by-products to lead and zinc. In order of tonnage of ore treated, they are Warman (Northair), Erickson, Highland Bell, Silmonac, Horn Silver, Mosquito Creek, Baker, Ruth Vermont, Scottie and Atlin-Ruffner. These small mines produced a total of 244 867 tonnes.

The year 1981 saw the opening of many mines of significant size in the province. These include Amax's Kitsault mine, DuPont's Baker mine, and Equity Silver's Equity (Sam Goosly) mine (70 per cent interest held by Placer Development Corporation). The Granduc copper-silver-gold operation was reopened during the year by Canada Wide Mines Ltd., a 100-per-cent owned subsidiary of Esso Minerals Canada.

Concentrating

Metal concentrators of various sizes totalled 33 during 1981. There were seven concentrators which treated copper-molybdenum ores, six treated copper ore, eight lead-zinc (-silver-gold), three molybdenum, two copper-iron, one copper-lead-zinc, and six gold-silver ores. Many concentrators, especially those treating lead-zinc-silver are small operations.

Lornex Mining Corporation Ltd. completed its expansion program during 1981 at its Highland Valley (Lornex) mine which approximately doubled production capacity. With the highest daily throughput capacity of any metal mine in Canada, Lornex has an annual production capacity of over 90 million kilograms of copper and 3 million kilograms of molybdenum. Teck's 13.0-per-cent share interest in Lornex was converted to a 73.0-per-cent direct working interest in the Afton mine and smelter complex, which produced 16.3 million kilograms of copper, 6.5 million grams of gold and 1.1 million grams of silver in 1981.

During the year, Placer Development Ltd. continued work on the Equity Silver leach plant and in the fourth quarter of 1981 some test quantities of leached concentrates were produced. In the meantime, the sale of unleached concentrate continued.

Smelting, Refining and Destination of Concentrates

The Trail smelter, the world's largest lead-zinc production complex, continued its $400 million expansion and modernization program in 1981. During the year, Trail received ore concentrates from 25 British Columbia mines. Chief sources are Cominco's own Sullivan mine at Kimberley and the Pine Point mine in the Northwest Territories. In 1981, the smelter received 130 613 tonnes of lead concentrates and 119 696 tonnes of zinc concentrates. Including by-product metal from British Columbia, the total value of concentrates received at Trail was $332 162 372, or 25.8 per cent of 1981 metal production in the province.

The roaster expansion at Endako was completed in 1981. Throughput capacity was increased substantially, including toll roasting for a number of mines in the province. Poor market demand for molybdenum however, caused reduction in the price of Endako's molybdenum output. Shipment of products from Endako decreased in 1981, containing 3 420 413 kilograms of molybdenum from 487 tonnes of molybdenum concentrates, 5 009 tonnes of molybdic oxide and 221 tonnes of ferro-molybdenum.

The majority of the ores and concentrates in this province are shipped out of the province for smelting and refining.

Destinations of ores and concentrates by value of metal content are as follows:

	Million $	*Per Cent*
Smelted or treated in British Columbia	231.1	18.5
Shipped to other parts of Canada	102.3	8.2
Exported to Japan	550	44.1
Exported to Korea	35.6	2.9
Exported to United States	22.3	1.8
Exported to Europe	207.9	16.7
Exported elsewhere or unattributed	97.6	7.8

Details on the destination of concentrates of metals produced in this province are presented in Tables 3-13A and 3-13B.

Copper concentrates production totalled 1 035 653 tonnes in 1981. Two-thirds, or 689 931 tonnes, were shipped to Japan. Other destinations were:

	Tonnes	*Per Cent*
Canada	130 080	12.6
Korea	59 263	5.7
Germany	38 004	3.7
Taiwan	31 251	3.0
Others	87 118	8.4

Total molybdenum production in 1981 amounted to 12 933 224 kg ($198 240 391). Of these almost one-half (48.4 per cent) went to Europe; 19.6 per cent to Japan; 10.5 per cent to United States; 6.7 per cent to Canada; and 14.8 per cent to other countries.

The majority of zinc concentrates were smelted in B.C. during 1981, with the exception of 965 tonnes smelted in the United States. All lead concentrates produced in B.C. were smelted at Trail.

Production of iron concentrates in the province totalled 602 272 tonnes. Japan is the largest customer, with the purchase of 443 729 tonnes (or 73.7 per cent) of the total. Other destinations include: Canada, 91 912 tonnes (15.3 per cent); Australia, 63 768 tonnes (9.4 per cent); and United States, 2 863 tonnes (0.5 per cent).

NON-METALLIC MINES

Production of industrial minerals in British Columbia totalled $122 464 842 in 1981, an increase of 5.6 per cent over $115 926 007 in 1980. The largest industrial mineral, asbestos, accounted for 62.7 per cent. This represents a continuation of decline in its share of total industrial minerals produced in this province, since it accounted for 77.6 per cent in 1979 and 70.5 per cent in 1980. In 1981 the value of sulphur, the second most valuable industrial mineral, rose from $21 712 359 in 1980 to $33 337 562 or 27.2 per cent of the total industrial mineral production. Other major industrial minerals include gypsum, jade, barite and stone granules.

All asbestos production is from the Cassiar mine. Sulphur is produced entirely as a by-product; Cominco's roasting operation provided 42.1 per cent of sulphur produced in this province, with the remainder produced by Petrosul International Limited from its sour gas production in the Peace River. Westroc Industries Ltd.'s Windermere mine is responsible for all gypsum production in the province. Production of barite, an important industrial mineral used in the oil and gas drilling industry, was mainly from Mountain Minerals Company Ltd.'s small underground mine and tailing deposits in the East Kootenays, but Baroid of Canada Ltd. also has a small operation of crude barite ore at Golden. There are numerous small producers of stone granules but over 80.0 per cent of production was from International Marble and Stone Company Ltd.'s operation at Nelson. Other industrial minerals such as fluxes, diatomite and jade are mainly produced by small producers, most of them with annual production values of $100 000 or less.

Production of structural materials declined substantially in 1981 to $200 786 279 following a significant surge in production in 1980. Major structural materials in British Columbia are sand and gravel, cement, limestone, clay products, rip-rap, crushed rock and building stone. Sand and gravel and cement accounted for over 85.0 per cent of the sub-group's production in British Columbia. Producers of sand and gravel with annual sales of over $2 million in 1981 were Construction Aggregates Ltd. in Vancouver, Jack Cewe Ltd., Goodbrand Industries Ltd., Allard Contractors Ltd. and Fraser Valley Aggregates Ltd. in New Westminster, and Port McNeil Enterprises Ltd. and Columbia Bitulithic Ltd. in Nanaimo. Cement, like other structural material, is mainly produced near major urban centres. Major producers of cement are Canada Cement Lafarge Ltd. (Richmond and Kamloops) and Genstar Ltd. in Vancouver. Rubble, rip-rap and crushed rock are primarily used by the railways. The production of clay products continued to be dominated by Clayburn Industries Ltd. in 1981. Lime and limestone shared in the decline in production of structural materials in 1981. Three major producers, Ideal Basic Industries, International Marble and Stone and Domtar accounted for 67.9 per cent of lime and limestone production in the province; Revelstoke Flagstone Quarry was the only reported producer of building stone.

COAL MINES

The value of coal production continued to grow in 1981 and reached a record level of $554 271 292. This resulted in coal being the third most valuable mineral commodity in the province, after natural gas, valued at $616 795 096 and copper valued at $611 282 050.

The largest coal operations are in the Crowsnest Coalfield in the southeast of the province. B.C. Coal Ltd., a subsidiary of the British Columbia Resources Investment Corporation, was the largest producer at 7 505 035 tonnes, followed by Fording Coal Ltd. at 3 721 184 tonnes and Esso Minerals Canada (Byron Creek) at 441 237 tonnes. B.C. Coal and Fording Coal produced 96.0 per cent of all clean coal in British Columbia in 1981. Bulkley Valley Collieries Ltd.'s mine at Telkwa was a minor producer of thermal coal.

The following developments in the province's coal industry during 1981 are worthy of note:

1. Coal sold and used increased significantly to 11 752 621 tonnes, an 8.6 per cent increase in tonnage.
2. The value of coal production rose by 20.0 per cent to a record level of $554 271 292.
3. Clean coal output was 11 742 526 tonnes, representing an increase of 16.0 per cent.
4. Surface mining operations accounted for 93.6 per cent of raw coal production.
5. 93.9 per cent of raw coal produced was of metallurgical quality.
6. The percentage of clean coal to raw coal was 75.8 per cent.

The diversification of markets continued in 1981 as substantial increases in sales to Korea, Brazil, Spain, Denmark and Italy were registered. The largest customer, Japan, purchased 65.2 per cent of total British Columbia coal production. Major shipments are as follows:

	Tonnes	Metallurgical (M) or Thermal (T)
Japan	7 493 246	7 357 069 (M), 136 177 (T)
Korea	1 696 019	M
Brazil	429 799	M
Denmark	319 249	T
Taiwan	274 486	M
Chile	247 847	M
Mexico	219 198	M
Sweden	163 659	M
Pakistan	105 284	M
U.S.A.	67 516	22 035 (M), 45 481 (T)
Belgium	55 813	T
Spain	53 877	T

Sales within Canada were up significantly, with 267 876 tonnes to Ontario, 61 682 tonnes within British Columbia and 35 178 tonnes to Manitoba. The amount of coal used for making coke by B.C. Coal was 261 068 tonnes, up some 49.0 per cent.

New Mines and Products in 1981

Twelve mines commenced or recommenced production in 1981. Six have precious metals—gold and silver—as primary products. Four others have significant by-product silver and/or gold with either lead, lead-zinc, or copper mineralization. The remaining two mines produce molybdenite and tungsten respectively. Five existing mines increased their production capacities; they produce molybdenum, copper-molybdenum, silver-copper-antimony-gold, and gold. One major copper-lead-zinc-gold-silver deposit (HW) was under development. A summary of activities in 1981 is as follows:

Twelve mines commenced production during the year:

— Morris Summit, gold (Scottie Gold Mines Ltd.)
— Ladner Creek/Idaho, gold (Carolin Mines Ltd.)
— Hanna, gold (United Hearne Resources Ltd./Taurus Resources Ltd.)
— Vollaug, gold (Plaza Mining Ltd.)
— Chappelle/Baker mine, gold (DuPont of Canada Ltd.)
— Dome Mountain/Free Gold, gold (Reako Exploration Ltd.)
— Ruth Vermont, silver-lead-zinc (Ruth Vermont Mines Ltd.)
— Granduc, copper-gold-silver (Canada Wide Mines Ltd.)
— Kitsault, molybdenum (Amax of Canada Ltd.)

- — Copper Mountain, copper-gold (Newmont Mines Ltd.)
- — Silence Lake, tungsten (Dimac Resources Corp.)
- — Hallmac, silver-lead-zinc (Hallmac Mines Ltd.)

Five metal mines increased production capacity:

- — Endako, molybdenum (Placer Development Ltd.)
- — Boss Mountain, molybdenum (Noranda Mines Ltd.)
- — Lornex, copper-molybdenum (Lornex Mining Corp. Ltd.)
- — Equity/Sam Goosly, silver-copper-antimony-gold (Equity Silver Mines Ltd.)
- — Erickson, gold (Erickson Gold Mining Corp.)

Five properties are under development:

- — Line Creek, coal (Crowsnest Industries Ltd.)
- — Greenhills, coal (B.C. Coal Ltd.)
- — Bullmoose, coal (Denison Mines Ltd.)
- — Quintette, coal (Denison Mines Ltd.)
- — HW, copper-lead-zinc (Westmin Resources Ltd.)

EXPLORATION

An increase in total mineral exploration of 41.5 per cent was registered during 1981, with expenditures increasing from $109.9 million in 1980 to $155.6 million. Exploration expenditures have been increasing rapidly since 1978, particularly for metal mines. However exploration expenditures for both metal and coal showed significant increases in 1981—metals increased by $26.1 million, coal by $19.9 million. Exploration for other non-metallic minerals, however, declined by about one-fifth from the 1980 level of $1.5 million to $1.2 million recorded in 1981.

Table 1-6—Metals Exploration

	1977	1978	1979	1980	1981
Exploration expenditure[1]	$26 177 389	$29 475 341	$53 810 829	$92 852 714	$118 946 075
Claims recorded	37 151*	37 242*	55 252*	72 349	71 667
Certificates of work	39 711	65 705	76 233	141 142	248 030
Free miners' certificates:					
Individual	7 566	9 444	14 591	18 840	16 260
Companies	520	531	643	994	1 161
Number of properties	561	647	781	1 054	1 276
Total drilling (metres)[2]	110 303.6	154 177	216 962	413 000	389 835
Total geophysical surveys (kilometres)[2]	14 623.5	9 135.5	27 520	19 280	20 008

* Unit modified grid system.

[1] Compiled by Mineral Economics Branch.

[2] Compiled by Geological Branch.

METALLIC MINERALS

Exploration effort for metals continued to increase sharply in 1981. Programs were widely distributed throughout the province and ranged in scope from regional grassroots exploration to extensive drilling programs. Major drill and underground development programs were also directed toward re-evaluating former producing mines. Commodities sought ranged from gold and silver in vein and bulk deposits, porphyry deposits of molybdenum, molybdenum-tungsten, copper-molybdenum or copper-gold, volcanogenic massive sulphide deposits, shale-hosted lead-zinc-barite deposits, and industrial minerals — a wide spectrum of activity.

Strongest emphasis was placed on the exploration for precious metals, a result of the record high gold prices reached in early 1981. However, exploration activity continued at a high level for volcanogenic and sediment-hosted massive sulphide deposits with precious metals.

Exploration for precious metals was distributed throughout the province with major activity in the Toodoggone, Cassiar, Stewart-Alice Arm, Bridge River-Chilcotin, Hedley and Queen Charlotte Islands.

Considerable interest was aroused by the results of SEREM Inc.'s 18-hole drilling program on the Lawyer's gold-silver prospect, which is near DuPont of Canada Exploration Limited's Baker mine in the Toodoggone River area. Gold-silver-bearing epithermal quartz veins occur in pyroclastic rocks of the "Toodoggone" group. Many other showings and alteration zones were being explored.

In Cassiar the success of Erickson mine in finding ore shoots continued to attract exploration to the regional quartz vein system.

The Big Missouri gold-silver deposit was again tested by an extensive 44-hole underground drilling program by Westmin Resources under agreement with Tournigan Mining. The results appear to indicate the likelihood of another economic deposit in the near future. Another major drilling program took place in 1981. British Premier Silbak Mines committed approximately $750 000 to an underground exploration program aimed at re-opening that former gold-silver mine.

In the nearby Alice Arm area, underground development and drilling carried out in 1980 by Dolly Varden Minerals led to the initiation of a $1.2-million program to re-open three silver mines, the North Star in 1981 and later the Wolf No. 1 and 2 deposits during 1981. Engineering and environmental studies were well underway.

In the Bridge River-Chilcotin area Bralorne Resources and E&B Exploration formed a joint venture to re-examine the old Bralorne mine west of Lillooet with the intent of re-opening this former underground gold producer. Blackdome continued its major drill program.

In the Queen Charlotte Islands, the Babe gold deposit on Graham Island, advanced through the preliminary feasibility stage. A 1 500-foot adit and crosscuts were driven to allow underground drilling and pilot plant milling of the ore. Consolidated Cinola Mines and its partners, Energy Reserves Canada, announced reserves of 43 million tons of 0.054 ounces/ton of gold. The deposit is estimated to contain at least 2.5 million ounces of micron-sized gold in a silicified zone adjacent to a strand of the Sandspit fault zone. Although this deposit is low grade, its high tonnage attracted a great deal of interest throughout the industry.

EXPLORATION FOR OTHER METALS

In the Coast Range, major drilling programs were conducted on the Red Bird molybdenum deposit by Craigmont Mines Limited and on the Mount Ogden molybdenum-tungsten deposit by Omni Resources Ltd.

In the south, 20th Century Energy Corporation conducted extensive drilling and testing of their porphyry copper-molybdenum deposit on Gambier Island.

In the north, Shell Canada Resources Ltd. explored the Storie molybdenum deposit near Cassiar, and Texasgulf Canada Ltd. did more drilling on its Boya tungsten-molybdenum deposit near the Kechika River.

Additional exploration work was done by Gataga Joint Venture on the Driftpile deposit, and by Cyprus Anvil Mining Corporation/Hudson's Bay Oil and Gas Company Limited on the Cirque lead-zinc-silver deposits in the Devonian Gunsteel Formation shale east of the Rocky Mountain Trench. The Cirque deposit contains approximately 27 000 000 tonnes grading 7.9 per cent zinc, 2.3 per cent lead, and 46 grams of silver per tonne. Despite its remote location, the Cirque deposit may warrant development in the late 1980s.

Major Exploration on Properties

Sixteen non-producing properties were reported as completing programs of 3 000 or more metres of drilling or 300 metres of underground development. This contrasts with 33 in 1980 and 16 in 1979. It shows exploration in 1981 although up in total was more widely dispersed and less concentrated in major drill programs.

FISH LAKE (Bethlehem Copper Corporation), 92O/5E—porphyry type of chalcopyrite and minor molybdenite mineralization occurs in a quartz diorite stock and hornfels; 9 616.5 metres of diamond drilling in 47 holes.

ROBB LAKE (Texasgulf Inc.), 94B/13E—sphalerite and galena occur in two stratabound levels of dolomitized carbonates and collapse breccias; 3 812.5 metres of diamond drilling in 13 holes.

Poplar (Utah Mines Ltd.), 93L/2W—chalcopyrite occurs in fractured and faulted rhyolte and chert which are intruded by small granitic plugs; 4 467.2 metres of diamond drilling in 15 holes.

Rainbow (Craigmont Mines Limited), 92I/9W—chalcopyrite with gold and silver values and molybdenite occur in shear zones; 5 579.0 metres of diamond drilling in 34 holes.

QR [Dome Exploration (Canada) Limited], 93A/12—gold values are found in pyritic tuffs and carbonate stringers cutting massive basalts; 7 064.0 metres of diamond drilling in 26 holes.

Little Tim (Svenson Way Mineral Services Ltd.), 82F/14W—native silver occurs in quartz veins cutting porphyritic granodiorite; 339 metres of underground development and 1 477.0 metres of diamond drilling in 31 holes.

Eaglehead (Nuspar Resources Limited; Esso Resources Canada Ltd.), 104I/6E, 11E—chalcopyrite, bornite, specularite, magnetite, sphalerite, and molybdenite occur in a contact area between granodiorite and sedimentary volcanic rocks; 3 329.0 metres of diamond drilling.

Vimy (Lawrence Mining Corp.), 92I/7W—bornite, native copper, chalcocite, chalcopyrite, minor covellite, and cuprite occur in fine-grained, altered granodiorite; 3 400.5 metres of diamond drilling in 20 holes and 2 301.2 metres of percussion drilling in 30 holes.

Whit (SMD Mining Co. Ltd.), 93E/11E, 14E—molybdenite occurs in a quartz porphyry plug, and copper mineralization is found in a granodiorite stock intruding pyritic volcanic rocks; 3 478.9 metres of diamond drilling in 18 holes and 1 020.9 metres of percussion drilling in 16 holes.

Schaft Creek (Teck Corporation), 104G/6E, 7W—copper and molybdenum sulphides are disseminated in joints cutting altered volcanic rocks adjacent to a large monzonite intrusion; 11 222.3 metres of diamond drilling in 81 holes.

Thanksgiving (Northair Mines Ltd.), 82M/1E—a skarn-scheelite zone is developed in carbonate rocks which are in thrust-fault contact with quartz biotite schist and pelitic argillaceous rocks; 1 819.5 metres of diamond drilling in 26 holes and 2 767.6 metres of percussion drilling in 59 holes.

Arlington (Svenson Way Mineral Services Ltd.), 82F/14W—galena, sphalerite, stephanite, tetrahedrite, native silver, and chalcopyrite occur in a hydrothermally altered shear zone in a multiple-intrusion environment; 2 517.3 metres of diamond drilling in 81 holes and 168 metres of underground development.

Blue, Verity [Anschutz (Canada) Mining Ltd.], 83D/6E—sill-like carbonatites occur in a sequence of alkaline gneisses and schists; 2 964.9 metres of diamond drilling in 28 holes.

Cedar (R. H. Stanfield), 82G/6W—minor chalcopyrite and galena occur in fractures and quartz-siderite veins cutting quartzite of the Aldridge Formation; 5 997.0 metres of diamond drilling in 6 holes.

Cariboo-Bell, BJ (E&B Explorations Limited), 93A/12E—porphyry-type gold and copper mineralization occurs in two breccia zones of alkaline rocks near the top of a subvolcanic intrusive complex; 1 745.6 metres of diamond drilling in 7 holes and 1 296.0 metres of rotary drilling in 7 holes.

Hope, Emancipation (Aquarius Resources Ltd.), 92H/6W, 11W—auriferous replacement mineralization occurs in sedimentary rocks of the Ladner Group; 1 771.0 metres of diamond drilling in 10 holes and 866 metres of underground development.

Development and Feasibility Studies

The following fifteen properties recorded continued Stage I and Stage II development with the Metal Mines Steering Committee.

Blackdome (Blackdome Exploration Ltd.), 92O/7E, 8W—gold occurs in a quartz vein fracture zone cutting rhyolite and andesite at Black Dome Mountain; ore reserves are approximately 300 000 tonnes grading 12 to 18 grams of gold and 110 to 138 grams of silver per tonne.

Bralorne (E&B Explorations Limited; Bralorne Resources Ltd.), 92J/15W—auriferous quartz-carbonate veins with minor sphalerite and scheelite occupy tension fractures cutting tuffs, minor chert, greenstone, and diorite within the Cadwallader fault zone of the Fraser fault system; accessible reserves are approximately 150 000 tonnes grading 10 grams of gold per tonne.

Babe (Consolidated Cinola Mines Ltd.), 103F/9E—gold is disseminated and in veins in hydrothermally altered sedimentary rocks adjacent to the Sandspit fault system; reserves are 41 000 000 tonnes grading 2.08 grams of gold per tonne.

Eaglet (Eaglet Mines Limited), 93A/10W—disseminated and stockwork fluorite occur in altered gneiss; reserves are 1 309 000 tonnes of 12 per cent fluorspar.

Kutcho Creek (Esso Minerals Canada; Sumac Mines Ltd.), 104I/1W—one large and a series of smaller cupriferous massive sulphide lenses occur in siliceous sericite schists; reserves are 11 000 000 tonnes grading 1.68 per cent copper, 2.14 per cent zinc, 25 grams silver, and 0.3 grams gold per tonne.

Carolin (Carolin Mines Ltd.), 92H/11W—auriferous quartz veinlets with minor chalcopyrite occur in argillites, wackes, and slates adjacent to the Coquihalla serpentine belt; reserves are 1 530 000 tonnes of 4.35 grams of gold per tonne.

Poison Mountain (Long Lac Mineral Exploration Ltd.), 92O/2E—copper, molybdenum, gold, and silver mineralization occurs in veins and fractures cutting porphyritic rocks which intrude sedimentary country rocks; reserves are approximately 175 000 000 tonnes of 0.33 per cent copper and 0.015 per cent molybdenum.

Skomac/Boundary Falls (Robert Mines Ltd.), 82E/1E—galena, tetrahedrite, gold, and silver occur in a pyritic quartz vein cutting altered sedimentary and volcanic rocks near a granitic intrusive; reserves are 41 000 tonnes grading 311 grams of silver and 3 grams of gold per tonne, 2 per cent zinc, and 2 per cent lead.

Hanna (United Hearne Resources Ltd.; Taurus Resources Ltd.), 104P/5E—gold occurs in quartz veins cutting basalts; reserves are 59 000 tonnes of 14 grams gold per tonne.

Trout Lake (Newmont Exploration of Canada Limited; Esso Resources Canada Ltd.), 82K/12E—stockwork molybdenite occurs in a small granodiorite plug intruding metasedimentary rocks; reserves are 50 000 000 tonnes of 0.23 per cent molybdenite.

Schaft Creek (Teck Corporation; Liard Copper Mines Ltd.), 104G/7W—chalcopyrite, bornite, molybdenite, and minor precious metals occur in strongly fractured pyroclastic rocks that are cut by quartz feldspar porphyry dykes and breccias in a structurally complex zone; reserves are 907 200 000 tonnes of 0.3 per cent copper and 0.034 per cent molybdenum.

VALLEY COPPER (Cominco Ltd.), 92I/6E—copper and lesser molybdenum mineralization occurs in veins and alteration zones in porphyritic quartz monzonite rocks of the Guichon Creek batholith; reserves are 725 760 000 tonnes of 0.475 per cent copper.

VIRGINIA SILVER (Virginia Silver Mines Ltd.), 93M/3W—sphalerite, galena, and tetrahedrite occur in pyritic veinlets and masses occupying a shear zone which transects sedimentary rocks.

VOLLAUG, DINO (Plaza Resources Ltd.), 104P/4E—a major east-west-trending auriferous quartz vein occurs between argillite and footwall greenstone; reserves are approximately 250 000 tonnes of 7 grams gold per tonne.

VOLLAUG WEST (Table Mountain Mines Ltd., a subsidiary of Silver Standard Mines Limited), 104P/4E—a number of small ore shoots have been defined at the west end of the Vollaug vein.

COAL EXPLORATION

Spurred by continued demand for coal, exploration remained at a high level. Strong programs were mounted in the Peace River Coalfield and also the Crowsnest and Groundhog Coalfields.

Exploration for coal showed a substantial increase in expenditures on undeclared mines during 1981, reaching a total of $35.4 million. The exploration activity became more intensive as the area under investigation, including freehold land, totalled 830 000 hectares covered by 2 503 coal licences at the end of 1981, compared to 900 000 hectares covered by 2 884 coal licences in 1980.

Table 1-7—Coal Mines

	1977	1978	1979	1980	1981
Coal licences issued	48	793	925	1 120	492
Area (ha) of coal licences issued	8 662	205 000	253 708	304 171	132 281
Total area (ha) under licence at year-end	243 116	496 721	682 755	741 171	668 805
Total coal licences at year-end	1 067	2 533	2 533	2 884	2 603

Almost two-thirds of coal exploration in 1981 took place in the Northeast Coalfield where dramatic increases were reported in exploration expenditure. Gulf Minerals Ltd. continued to be the dominant leader in the area. Other major contributors to the increased activity in 1981 were Crowsnest Resources, Petrocan and David Minerals. The Stage I reports were submitted by Willow Creek (MacLeod) and Cinnabar Peak (Cinnabar Peak Mines Ltd.) during the year. The Stage II report for Sukunka (B.P. Minerals) submitted at the end of 1979 was approved in 1981.

The major continuing exploration programs took place in the Peace River area of the following properties: Quintette and Belcourt (Denison); Burnt River (Brameda); Bri-Dowling Creek (Utah).

In the southeast, B.C. Coal was responsible for the largest portion of coal exploration during 1981. A major exploration project took place in the Michel mining area of B.C. Coal's Sparwood property. Elsewhere in British Columbia, major exploration expenditure was spent at Hat Creek (B.C. Hydro), Bowron River (Norco) and Sage Creek (Rio Algom).

Activity was intensive in the Comox and Nanaimo Coalfields as well as the Bowron River coal deposits. Elsewhere in British Columbia in the Telkwa, Suquash, Princeton, Merritt and Tuya coal areas, exploration was moderate.

Four coal properties were under development in 1981, two in the southeast, Line Creek (Crowsnest Resources) and Greenhills (B.C. Coal), and two in the northeast, Bullmoose (Teck Corporation) and Quintette (Denison Mines).

Activity of the Mineral Resources Division

CHAPTER 2

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HISTORY AND DEVELOPMENT

The Mineral Resources Division has had a long history of development that started in the mid-nineteenth century as a system of Gold Commissioners and mining recorders to administer placer titles under the Provincial Secretary. In 1874, a Department of Mines was created, gathering together the elements concerned with mining but it was not a truly separate entity. A Bureau of Mines was created by an act of that name in 1895 which initiated the development of the technical elements of the Department, however, the Department did not have a separate Minister and Deputy Minister until the *Department of Mines Act* of 1899. Nevertheless, the Department and its mission evolved from being simply administration of title to one of recording progress of the industry, stimulation of exploration, and safety in quarries and coal and metal mines. In 1953, the Department took over administration of the *Petroleum and Natural Gas Act* and the *Coal Act* from the Department of Lands and thereafter administered title to coal lands as well as coal mine safety. Name changes occurred in 1960 to the Department of Mines and Petroleum Resources and in 1967 to Ministry. In a general realignment of Ministries in December 1978 the mandate was enlarged again to include responsibility for energy matters and it became the Ministry of Energy, Mines and Petroleum Resources. The solid mineral elements of the Ministry form the Mineral Resources Division, the largest of the three operation divisions.

The Mineral Resources Division now maintains the tenure records of mineral claims, placer leases, and coal licences; provides the inspection and engineering services for worker and public safety in and around mines; ensures optimum extraction of mineral resources and reclamation of land disturbed by mining; carries out geoscientific surveys, studies, and compilations to assist and to stimulate mineral exploration and maximize access to the land base of the province for exploration; makes analyses for the government respecting the economic conditions, land use, and taxation factors as they relate to the mineral industry; and administers guidelines to new mine development. To carry out these tasks it is organized into four branches: Titles, Inspection and Engineering, Geological, and Mineral Economics.

The branches of the Division developed sequentially, as need dictated, starting with the appointment of the first Gold Commissioner in 1859 to administer placer title under the Provincial Secretary. The majority of recording offices are still not part of the Ministry as Government Agents act as Gold Commissioners and sub-recorders. A Chief Gold Commissioner was appointed as a Departmental official in 1937, and a central records office was created in Victoria in the same year followed thereafter by one in Vancouver. Claim inspectors were first appointed in 1974 and a Titles Division created.

A Provincial Mineralogist was appointed in 1895 in charge of a Bureau of Mines that was to record and assist the development of the mining industry. Initially, the Bureau consisted only of the Provincial Mineralogist and Provincial Assayer. Some additional staff was added leading to reorganization of the Bureau into six mineral survey districts with Resident Engineers appointed under the *Mineral Survey and Development Act* in 1917. The Bureau continued in this manner until 1934 when it was reorganized to become the Mineralogical Branch consisting of geological engineers based in Victoria. This evolved to the present Geological Division (now Branch) in 1974 and at the same time district geologists' offices were once again established in addition to the geological survey offices in Victoria.

The first Inspector of Mines was appointed in 1877 at Nanaimo to supervise mine safety in the coal mines of Vancouver Island. An inspector of metalliferous mines was appointed, based in Nelson, in 1897. Two other inspectors were appointed soon after to inspect coal in the Crowsnest coalfield and other metalliferous mines. A Chief Inspector was appointed in 1908 with augmented staff but the Branch was not created until 1929. It evolved with wider engineering and resource duties into the Inspection and Engineering Branch of today.

The last element to be created was the Mineral Economics Branch although its statistical duties had been performed first by the Bureau and then by the predecessor of Industrial and Small Business Development. This was returned to the Ministry in 1974 as part of the Economics and Planning Division that acted for the whole Ministry. In 1976, this became the Mineral Economics Division (now Branch) with a focus on mineral resources.

LEGISLATION

During 1981 legislative changes to acts administered by the division were minimal. Regulations for the unproclaimed Mines Act were still in preparation. Two acts of interest to the mining industry but administered by Finance and Administration Division were revised.

The *Mineral Resource Tax Act* was amended to preserve the mine specific intent of the act and to allow for the payment of interest where the taxpayer has paid in excess of the actual tax liability.

The *Mineral Land Tax Act* was amended in the following areas:

—to increase the size of exempt mineral land to 16.2 hectares
—to exempt registered charities
—to amend the definition of mineral
—allow for the deemed assessment of mineral land where tax notices were returned
—access a penalty of $50 on delinquent taxes
—allow for the returning of mineral land forfeited in error.

ACTIVITY OF THE MINERAL RESOURCES DIVISION

The Mineral Resources Division consists of four Branches whose functions are adequately revealed by their names: Inspection and Engineering, Geological, Titles, and Mineral Economics. E. R. MacGregor, formerly Assistant Deputy Minister of the Division, became Assistant Deputy Minister of Energy Resources Division late in 1980 and a new Assistant Deputy Minister, Dr. A. J. Freyman, was appointed in the spring of 1981.

INSPECTION AND ENGINEERING BRANCH

Coal mines, metal mines, and quarries were inspected during the year, in accordance with the *Mining Regulation Act* and the *Coal Mine Regulation Act*, by inspectors stationed at the following listed locations. Specialized research and support for field inspections were provided by Victoria-based professionals in the areas of reclamation, environment, geotechnical, mechanical/electrical, and electrical. Mining roads and trails are a separate program within the Branch. Mine-rescue training was a continuous program administered by mine-rescue training coordinators for the areas in which their stations were located.

Staff

Inspectors and Resident Engineers

W. C. Robinson, Chief Inspector of Mines	Victoria
V. E. Dawson, Deputy Chief Inspector of Mines (Coal and Special Services)	Victoria
A. J. Richardson, Deputy Chief Inspector of Mines (Metal)	Victoria
H. J. Dennis, Senior Inspector of Mines (Coal)	Victoria
T. G. Carter, Senior Mechanical-Electrical Inspector	Victoria
R. F. King, Electrical Inspector	Victoria
E. L. Seronik, Acting Road Engineer	Victoria
D. Pearce, Office Technician	Victoria
D. J. Murray, Senior Environmental Control Inspector	Victoria
J. D. McDonald, Senior Reclamation Inspector	Victoria
D. M. Galbraith, Reclamation Inspector	Victoria
J. C. Errington, Reclamation Inspector (Agrologist)	Victoria
R. T. Martin, Geotechnical Inspector	Victoria
R. Kumar, Environmental Control Inspector	Vancouver
V. Pyplacz, Environmental Control Inspector (Audiology)	Vancouver
J. E. Beswick, Environmental Control Inspector-Technician	Vancouver
A. Parker, Environmental Control (Noise) Inspector-Technician	Vancouver
B. M. Dudas, Inspector of Mines and Resident Engineer	Vancouver
W. H. Childress, Inspector of Mines-Technician	Vancouver
J. W. Robinson, Inspector of Mines and Resident Engineer	Nanaimo
H. A. Armour, Inspector of Mines-Technician	Nanaimo
V. A. Pakalniskis, Inspector of Mines and Resident Engineer	Prince Rupert
B. Varkonyi, Inspector of Mines-Technician	Prince Rupert
S. J. Hunter, Inspector of Mines and Resident Engineer	Smithers
R. W. Lewis, Inspector of Mines and Resident Engineer	Prince George
T. Vaughan-Thomas, Inspector of Mines and Resident Engineer	Prince George
J. J. Sutherland, Inspector of Mines-Technician	Prince George
B. A. Gordon, Reclamation Inspector-Technician	Prince George
K. G. Hughes, Mechanical Inspector-Technician	Prince George
R. Bone, Inspector of Mines and Resident Engineer	Fernie
G. A. MacDonald, Mechanical Inspector-Technician	Fernie
D. Smith, Inspector of Mines and Resident Engineer	Kamloops

Inspectors and Resident Engineers—Continued

E. S. Sadar, Inspector of Mines and Resident Engineer	Kamloops
J. P. MacCulloch, Inspector of Mines and Resident Engineer	Kamloops
J. A. Thomson, Inspector of Mines-Technician	Kamloops
R. H. Heistad, Mechanical Inspector-Technician	Kamloops
J. B. C. Lang, Inspector of Mines and Resident Engineer	Nelson
M. A. Mellor, Inspector of Mines-Technician	Nelson
A. L. O'Bryan, Reclamation Inspector-Technician	Nelson
E. J. Hall, Reclamation Inspector-Technician	Fort St. John

Coordinators, Mine-Rescue Training

G. J. Lee, Senior Coordinator	Victoria
R. F. Bow	Nanaimo
J. E. A. Lovestrom	Smithers
R. J. Stevenson	Prince George
B. A. McConachie	Kamloops
E. C. Ingham	Nelson
P. J. Switzer	Fernie

Staff Changes

In February, J. Cartwright resigned from the staff as Electrical Inspector.

In March, S. Elias retired from the staff as Senior Environmental Inspector.

In April, P. E. Olson retired from the staff as Road Engineer.

In October, R. J. Stevenson resigned from the staff as Mine Rescue Coordinator.

In October, D. I. R. Henderson resigned from the staff as Inspector of Mines and Resident Engineer.

J. E. Beswick joined the Ministry as Reclamation Inspector-Technician in the Vancouver office on January 5, 1981.

G. A. MacDonald joined the Ministry as Mechanical Inspector-Technician in the Fernie office on February 2, 1981.

E. Seronik joined the Ministry as Acting Road Engineer on April 21, 1981.

R. F. King joined the Ministry as Electrical Inspector on June 29, 1981.

D. Pearce joined the Ministry as Office Technician on November 16, 1981.

On November 18, 1981, D. J. Murray, Senior Environmental Control Inspector, was transferred from the Vancouver office to the Victoria office.

Mine Inspection and Safety

The *Mining Regulation Act* and the *Coal Mine Regulation Act* were enacted to facilitate the maximum possible recovery of resources from mining operations while minimizing personal injury and property damage by containing these operations within the bounds of safe and proper engineering practices. The Inspection and Engineering Branch has the responsibility of enforcing these Acts and ensuring that acceptable actions are carried out by persons engaged in mining in the province. The Branch maintains a province-wide system of districts staffed by experienced professional, technical, and support personnel, together with additional specialized personnel based in Victoria.

Safety programs and inspection routines were in effect at mine operations throughout the year. Good cooperation continues to exist with the mining community.

Employees at the mines themselves are tested for various certificates of competency depending on their supervisory functions. The examinations, conducted by or on behalf of Boards of Examiners appointed from the Inspection and Engineering Branch, are designed to ensure that the candidate has adequate knowledge of safe operating procedures as established in the Acts. In addition, miners' certificates, coal miners' certificates, and blasting certificates are issued by District Inspectors.

The following areas fall within the responsibility of the Inspection and Engineering Branch.

Mine Rescue and First-Aid

The growth in the mining industry continued to place a heavy demand on mine rescue and first-aid training services in 1981. A new course concerning back problems was added to our training syllabus.

Mine rescue training stations were maintained at six districts under the supervision of coordinators who are fully qualified in all aspects of first-aid and mine rescue. These districts are, as follows: Fernie, Nelson, Kamloops, Nanaimo, Prince George and Smithers. Each station is established as a mobile unit to transport equipment anywhere in these areas to be available for either rescue or training services, and is equipped with sufficient self-contained, oxygen-supplying, breathing equipment to maintain at least three rescue teams of five men each, should an emergency arise in the nearby mines. In addition to this equipment, the Ministry loans equipment to supplement that owned by various mining companies.

In 1981, the mine rescue equipment owned by this Ministry was 59 Aerorlox three hour liquid oxygen breathing machines, 43 Draeger BG-174 four-hour high pressure gaseous-oxygen breathing machines, and 25 Demand thirty-minute units. The equipment owned by industry was 30 Aerorlox, and 69 Draeger BG-174. Each station, as well as most mines, has additional auxiliary equipment such as Type N gas masks, self-rescuers, gas detectors, oxygen therapy units and first-aid equipment.

The district coordinators of rescue training make periodic visits to the mines to give rescue training to open-pit and underground employees and to check the rescue equipment to ensure its serviceability.

Both full and refresher courses in underground, survival, gravel pit and surface mine resue training, as well as first-aid, were presented by the district coordinators at various mines and centres throughout the province. The coordinators trained or assisted in the training of 238 persons obtaining St. John Ambulance first-aid certificates, 139 safety oriented first-aid certificates, 10 in Industrial First-Aid, 187 in underground mine rescue work, 390 in surface mine rescue, 31 in gravel pit rescue, 685 in mine rescue survival course, 26 received Surface Mine Rescue Instructors' certificates, 2 received a Survival Mine Rescue Instructors' certificate, 3 received Advanced Mine Rescue certificates and 250 received talks on back problems.

Four mine safety associations have been established in different areas in the province. These are supported by the Ministry of Energy, Mines and Petroleum Resources and are aided by mining company officials, safety supervisors, inspectors of mines, mine rescue coordinators and, in some areas, local industry. These organizations promote mine rescue and first-aid training, as well as safety education in their various districts.

On May 23 the East Kootenay Mine Safety Association held their 60th Mine Rescue and First-Aid competition in Fernie. In the Underground Mine Rescue event the Cominco Sullivan Mines' team from Kimberley, captained by A. Stuart, won the trophy. In the Surface Mine Rescue event the team from Brenda Mines, captained by K. Chilpon, placed first.

On May 30 the Vancouver Island Mine and Industrial Safety Association held their 67th Annual Mine Rescue and First-Aid competition in Nanaimo. In the Underground Mine Rescue event the Wesfrob Mines Ltd. team, captained by J. Doyle, won first place. The Boss Mountain Mine team, captained by J. Harriman, won the Central Zone event. In the Open Pit Mine Rescue event the team from Island Copper, captained by J. Pelletier, placed first.

On May 30 the West Kootenay Mine Safety Association held their 35th Annual Mine Rescue and First-Aid competition in Nelson and the team from B.C. Coal mine, captained by P. Zeith, won the Underground Mine Rescue event.

On June 6 the Central B.C. Mine Safety Association held their 32nd Annual Mine Rescue and First-Aid competition in Smithers, and the team from Cassiar Asbestos, captained by S. Hanley, won the trophy.

On June 13 the Provincial Underground Mine Rescue, Surface Mine Rescue, Three-Person Miner First-Aid and Underground Bench Competitions were held in Kamloops. In the Surface Mine Rescue event the Cassiar Asbestos mine team from Cassiar, captained by S. Hanley, placed first. In the Underground Mine Rescue event the Cominco Sullivan mine team from Kimberley, captained by A. Stuart, won the trophy. This team went on to compete in the Canadian meet, held in Banff, Alberta on June 20 and won the trophy. In the Underground Bench event, the Cominco Sullivan mine team from Kimberley, captained by A. Stuart, placed first. In the Three-Person Miner First-Aid event, the Similkameen mine team, captained by G. Mintzier, won the trophy.

There were six provinces competing in the Canadian Meet—British Columbia, Yukon, N.W.T., Alberta, Saskatchewan and Nova Scotia.

Reclamation

Reclamation is administered by the Inspection and Engineering Branch, under the authority of section 10 of the *Mining Regulation Act*, and section 9 of the *Coal Mine Regulation Act*. The objective is to restore lands used in mining and exploration development to a useful state, compatible with the surrounding countryside. Reclamation legislation does not apply to land disturbed by mining prior to April 1969.

Reclamation permits are issued by the Minister for metal mines, coal mines and coal exploration based upon review by the Advisory Committee on Reclamation, an inter-agency committee. This committee was regionalized for the northeast and southeast coal blocks and now reviews all coal exploration programs. A total of 85 reclamation permits (51 metal, 34 coal and coal exploration) is currently in effect.

Reclamation permits for mineral exploration, placer, sand and gravel, and quarries are issued by the Chief Inspector of Mines based on an informal review by the Ministry of Environment, Ministry of Lands, Parks and Housing and Ministry of Forests. At year end there were 301 mineral exploration, 196 placer, 233 sand and gravel and 43 quarry reclamation permits.

Reclamation progressed satisfactorily during 1981 and particularly in the coal mining industry. Four active coal operations (and one dormant) reported a total disturbance of 3 429 hectares, of which 176 hectares were revegetated during 1981. The total amount revegetated since 1969 now stands at 1 930 hectares for coal mines.

The Ministry funded a reclamation land use study of the Highland Valley as part of an M.Sc thesis at the University of British Columbia. The final report will be submitted in 1982.

The Ministry continued to fund the Princeton Tailings irrigation project. Approximately 45 tons of alfalfa was harvested from the 12 hectares under irrigation. This is almost three times more than the previous harvest.

The Fifth Annual Mine Reclamation Symposium and Sixth Annual Canadian Land Reclamation Association Meeting was held in August 1981. This was jointly sponsored by the Ministry of Energy, Mines and Petroleum Resources, the Mining Association of British Columbia, and the Canadian Land Reclamation Association. Approximately three hundred participants attended the three-day session and heard talks on reclamation in mountainous areas and went on field visits to Cominco's Sullivan mine, B.C. Coal and Fording Coal.

During the symposium, the Mine Reclamation Award for 1980 was presented to Utah Mines Ltd.'s Island Copper mine for its excellent reclamation and research program. Citations were given to Newmont's Similkameen operation, Sage Creek Coal and B.C. Coal.

Safety of Mechanical/Electrical Equipment

Mining activity continued at a high pitch during 1981 although some abatement occurred at the metal mining operations as the year progressed. Construction of new plant and facilities progressed at a rapid pace in the southeast coalfield and the amount of contractors' equipment in this area remained at a high level. The introduction of equipment, particularly that of a mobile nature, by contractors onto minesites invariably causes problems of compliance with our mining acts as very often this equipment has been in use at sites regulated by other jurisdictions whose requirements may differ from our own. In order that delays in construction could be avoided many meetings were held with both mining companies and contractors to help in identifying potential problems of this nature.

During the year a diesel-powered vehicle was qualified for use at underground coal mines. The vehicle is remarkable in that it probably incorporates in its design the most advanced engineering techniques available to ensure safety of operation in an underground coal environment. Since the introduction of the first model several additional units have been placed into operation.

The introduction of new models of heavy haul trucks into surface mines continues with a trend towards all-hydraulic braking from the more usual air/hydraulic systems, while a number of such vehicles in the lower capacity range were employing braking systems using air actuation only. Close monitoring of safety systems, together with physical testing, continues to be an important part of the branch's work in the acceptance of new equipment.

Electrical engineering reviews and inspections of new and existing mines continued with the increased mining activity.

Considerable time has been devoted to the review of the new Part V (Use of Electricity in Mines) of the Canadian Electrical Code, which will be completed during 1982. Other proposed changes in electrical standards are also receiving examination and assessment for possible inclusion in the *Mining Regulation Act* and the *Coal Mine Regulation Act*.

Geotechnical Engineering

Nineteen eighty-one was the first full year in which geotechnical engineering work was carried out by a separate section, the Geotechnical Section, under Special Services.

Geotechnical Engineering straddles the division between engineering and geology, and needs elements from Civil Engineering, Mining Engineering, Engineering Geology, and to some extent geology. The main fields covered are the mechanics of soil and/or rocks, foundations design, embankment design, and geomorphology. The work of this section in the Ministry presently deals with the regulation of impoundments for minesite runoff or tailings from concentrators, of stability of slopes on pits and dumps, and of a few other special problems such as haul roads or water diversions at mines.

Apart from a few isolated water-retaining structures most of the work in the section involved the regulation of impoundments of major proportions consisting principally of tailings. In 1981 there were 26 major tailings impoundments scattered throughout the province; most of these were inspected by the senior Geotechnical Inspector at least once. Eleven applications for new ponds or significant modifications of existing ponds and facilities were recommended for approval to the Chief Inspector and the limitation of use was ordered in one insecure structure during the year. Although a number of impoundments were voluntarily terminated during the year, the number of operating tailings facilities remained the same as that of the previous year.

Virtually every open pit mine in British Columbia has both a pit wall or dump slope that must be inspected. These are done regularly by the District Inspectors, but in 1981 the Senior Geotechnical Inspector also conducted 13 independent inspections of these features in most of the districts of the province. In addition, five approvals of new or modified pits and/or dumps were recommended for approval to the Chief Inspector.

During 1981 four water controlling schemes at mines were also approved. Although management of the water resource is not the responsibility of this Ministry, it was necessary for the Senior Geotechnical Inspector to review these projects to ensure that they provide adequate stability to protect the public.

A number of minor failures occurred during the year, but neither injury nor serious damage resulted. A few dangerous or undesirable situations were indentified in the existing operations, and appropriate measures were taken to mitigate them. In its various geotechnical submissions for approval, the mining industry has generally demonstrated both an awareness of the problems and a willingness to deal with them in acceptable ways.

Environmental

The Environmental Inspection section is responsible for the testing and maintenance of safe atmospheric, radiometric and audiometric working conditions in mine environments.

Monitoring of dust, ventilation and noise conditions continued at most mining operations and in addition, radiation surveys were made for radon daughter elements and gamma radiation at four underground mines. In instances where environmental conditions were found to be unsatisfactory, management was requested to take remedial action. Audiometric testing of mine employees was continued at most mining operations. Cooperation from mine management and employees has been good.

Mining and Petroleum Roads

The Ministry of Energy, Mines and Petroleum Resources road program continued during 1981 under the authority of the *Ministry of Energy, Mines and Petroleum Resources Act*.

The purpose of the program is to encourage and assist in the development of mineral and fossil fuel resources in the province by building general resource roads and participation in shared-cost projects with development companies.

In 1981, $200 000 was spent to maintain the all-weather road to the Sierra-Yoyo gas-producing area east of Fort Nelson and $200 000 was spent to maintain and upgrade the Omineca mining road.

Approximately $79 464 was granted to mine shared-cost projects throughout the province for improving and constructing access roads to properties and one airstrip.

Mine Development Guidelines

The Inspection and Engineering Branch is responsible for the day-to-day administration of the *Procedures for Obtaining Approval of Metal Mine Development* (April 1979) and the *Guidelines for Coal Development* (March 1976), responsibility for the latter having been assigned to the Branch in late 1980. The Branch provides the Chairman, Vice-Chairman and Secretary for both the Metal Mines Steering Committee and the Coal Guidelines Steering Committee.

The year 1981 was not very active for the Metal Mines Guidelines Review Process, reflecting depressed metal markets. Four mines were designated "small", and are now at the licensing stage (Stage III). Submissions were received from two "large" mines, that is, mines for which a Stage II submission is required. Finally, one "large" mine received Stage II approval-in-principle.

The Coal Guidelines Review Process was more active, reflecting recently improved coal marketing prospects. Four companies filed Stage I reports for new projects, and introductory briefs were also submitted for four proposed expansions of existing coal mines. Two companies filed Stage II submissions, while two other companies received Stage II approval-in-principle for their project proposals.

GEOLOGICAL BRANCH

Goal and Objectives

Metals, nonmetallic minerals, and coal are nonrenewable judged by the scale of man's lifetime. The province's needs for these commodities for our own use and for export are fulfilled only by continuous exploration and discovery. The fundamental role of the Geological Branch is to facilitate the renewal process and the orderly development of the solid mineral resources.

Organization

To carry out the objectives, the Branch is organized into four sections: Geoscience Projects, Applied Programs, Resource Data and Analysis, and Analytical Laboratory, the work of which is described subsequently as shown on Figure 2-1 with tasks as shown in Table 2-1.

Table 2-1—Mineral Resources
Geological Branch Management and Organization Matrix

Disciplines and Field of Interest	Organization and Program Responsibility			
	Project	Applied	Resource Data	Laboratory
Resource Type				
Metallic	*	*	*	*
Nonmetallic	–	–	*	+
Coal	*	*	*	*
Geothermal	–			
Research and Development				
Geoscience research	*	+	–	–
Geological surveys	*	+	–	*
Geochemical surveys and control	*	–	–	*
Analytical method development	–			
Functions				
Land-use analysis and management	–	+	*	
Resource inventory analysis and management	–	+	*	
Industry intelligence	+	*	*	
Consultation service	*	*	*	+
Data processing	–		*	–
Core storage		*		
Prospector training	+	*	–	–
Geologist training	*	–	–	
Assayer certification				*

* = major role; + = important role; – = minor role; (blank) = nil.

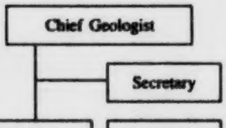
Staff

The staff establishment on December 31, 1981, included 54 permanent positions, 10 of which were vacant. Staff turnover therefore was a serious impediment to successful implementation of the objective of the Branch. Nine and a half man-years of continuing

auxiliary or contract staff helped the Branch function but most were in junior capacities. The vacant positions included the following: senior staff—the Manager and Assistant Manager of Applied Programs and the Senior Land-Use Geologist. However, at the end of the year, seven of these positions were advertised and under competition.

Figure 2-1—Organization, Manpower, Budget
Geological Branch

31st December, 1981



Staff		Resource Data and Analysis	Geoscience Projects	Applied Programs	Analytical Laboratory	General Management	Branch Total
Permanent		9	16	7	10	2	44 man-years
Vacant		3	2	5	0	—	10 man-years
Auxiliary:	Continuing	5½	11	3	2	—	10½ man-years
	Summer	3½	5	½	½		9½ man-years
Budget:	80/81	$420.8k	$894.7k	$498.6k	$344.7k	$100.4k	$2 229.8k
	81/82	$656.2k	$856.7k	$530.8k	$393.5k	$101.2k	$2 558.6k

Supplementary Programs

	Computerizing Coal Inventory	Regional Geochemical Surveys Related Research	Prospectors' Assistance		
80/81	$61.5k	$410.0k	$283.2k		$754.7k
81/82	0	$372.9k	$310.0k		$682.9k
				Grand total 80/81	$2 984.5k
				81/82	$3 241.5k

The permanent establishment included 29 geoscientists, 6 analytical chemists, 14 technicians and technical assistants, and 6 office assistants.

The contract and continuing auxiliary staff included the following man-years: 3.5 geoscientists, 1 chemist, 4 technical assistants, and 2 office assistants. The chemist was Mr. Paul Riehm, on sabbatical leave from Mohawk College, Hamilton, Ontario.

The professional, technical, and supervisory staff at December 31, 1981, was as follows:

A. Sutherland Brown, Ph.D., P.Eng. .... Chief Geologist

Geoscience Projects

W. J. McMillan, Ph.D., P.Eng.	Manager
D. Alldrick, M.Sc.	Project Geologist
B. N. Church, Ph.D., P.Eng.	Senior Project Geologist
G. E. P. Eastwood, Ph.D., P.Eng.	Senior Project Geologist
T. Höy, Ph.D., P.Eng.	Senior Project Geologist
D. G. MacIntyre, Ph.D., P.Eng.	Project Geologist
A. Panteleyev, Ph.D., P.Eng.	Senior Project Geologist
V. A. Preto, Ph.D., P.Eng.	Senior Project Geologist
G. E. Ray, Ph.D., P.Eng.	Project Geologist
Vacant	Geologist

Geoscience Projects—Continued

Vacant	Geologist
J. L. Armitage	Chief Draughtsman
R. E. Player	Lapidary and Photographer

Applied Programs

Vacant	Manager
Vacant	Deputy Manager
G. G. Addie, M.Sc., P.Eng.	District Geologist Nelson
D. A. Grieve, M.Sc.	District Geologist, Fernie
Vacant	District Geologist, Fort St. John
Vacant	District Geologist, Prince George
T. G. Schroeter, M.Sc., P.Eng.	Distict Geologist, Smithers
G. P. E. White, B.Sc., P.Eng.	District Geologist, Kamloops
G. V. White, B.Sc.	Engineering Assistant, Fort St. John

Resource Data and Analysis

J. G. McArthur, M.Sc.	Manager
Z. D. Hora, M.Sc.	Industrial Minerals Geologist
Vacant	Senior Land-Use Geologist
Vacant	Resource Analyst Geologist
T. E. Kalnins, B.Sc., P.Eng.	Geologist
Allan Wilcox, B.Sc.	Mineral Inventory Systems Geologist
Vacant	Mineral Inventory Geologist
A. Matheson, B.Sc.	Coal Resources Geologist
C. Kenyon, B.Ed., B.Sc.	Coal Inventory Systems Geologist
C. Sturko, B.A.	Engineering Aide
J. Young, B.A.*	Engineering Aide
J. Thompson, B.A.*	Engineering Aide
N. McKechnie*	Consultant, Report Review
C. Ritchie	Resource Data Information Officer

Analytical Laboratory

W. M. Johnson, Ph.D.	Chief Analyst and Manager
P. F. Ralph, L.R.I.C.	Deputy Chief Analyst
B. Bhagwanani, B.Sc.	Laboratory Scientist
R. J. Hibberson, B.Sc.	Laboratory Scientist
Y. T. J. Kwong, M.Sc.	Laboratory Scientist
V. V. B. Vilkos, Ph.D.	Laboratory Scientist
M. A. Chaudhry	Laboratory Technician
F. F. Karpick	Laboratory Technician
L. E. Sheppard	Laboratory Technician

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* Contract.

Staff Changes

The serious staff turnover that started in 1980 continued through 1981, but by the end of the year, five positions had been filled and seven were advertised. Some of the vacancies that occurred in 1981 were the result of resignations at the end of 1980. These included: Dr. E. W. Grove, Manager of Applied Programs, who left to set up his own consulting practice; Dr. D. E. Pearson, Senior Project Geologist, who did likewise; and

Mr. R. H. Karst, District Geologist at Charlie Lake, who left to become Senior Mine Geologist at Manalta Coal Ltd. at Hinton, Alberta. In addition, Mr. R. D. Gilchrist, Coal Project Geologist, left for Crows Nest Resources Ltd.; Mr. G. H. Klein, District Geologist, Prince George, left to form a company Northgane Minerals; and Mr. J. E. Forester, Mineral Inventory Geologist, left because of health reasons.

The Branch was fortunate to attract three promising new staff during the year and appointed two after several years of service in auxiliary positions. Geoscience Projects acquired the services of Dr. G. E. Ray from Energy Reserve Corp., Calgary, and Mr. D. Alldrick from Pine Point Mines Ltd. Mr. Allan Wilcox came from the Department of Indian Affairs and Northern Development, Ottawa, to join the Mineral Resource Inventory. In addition Candace Kenyon was appointed Research Officer and Claudia Sturko, Engineering Assistant, in the Coal Resource Inventory.

Mr. A. F. Shepherd, recently retired as Assistant Manager of Applied Programs, returned on contract to act as Manager. Mr. G. V. White, Engineering Assistant at Charlie Lake, returned to the University of British Columbia on leave of absence to finish his B.Sc.

The Work of the Branch

The distribution of major projects in 1981 and of district offices, regional geochemical surveys, and map-areas are shown on Figure 2-2 and the projects are summarized in Table 2-2.

Table 2-2—Major Projects in 1981

Project and Commodity	NTS Area	Map Publication Scale	Principal Investigators
(a) Cassiar precious metal deposits (Au, Ag)	104	1:25 000	A. Panteleyev and L. J. Diakow
(b) Toodoggone volcanic rocks (Au, Ag)	94	1:25 000	T. G. Schroeter*, A. Panteleyev, and L. J. Diakow
(c) Northeast British Columbia lead and zinc resources, Akie River area	94	1:50 000	D. G. MacIntyre, D. Lowey, and L. J. Diakow
(d) Correlation in Northeast Coalfield—palynology of coal measures	94	—	J. Broatch
(e) Gravity survey in Tulameen Coal Basin	92	1:25 000	B. N. Church
(f) Coquihalla Ultramafic Belt gold deposits	92	1:25 000	G. E. Ray
(g) Tertiary Intermontane Basins—energy and mineral resources	Various	1:50 000	B. N. Church
(h) Sicker Group (Cu, Zn, Au, Ag)	92B	1:25 000	G. E. P. Eastwood
(i) Southeast Coalfield	82G	1:25 000	D. A. Grieve*
(j) Carbonatites near Blue River	83D	—	G. P. E. White*

* District Geologist

Geoscience Projects

The work of this section is devoted principally to geological mapping of areas important for mineral resources and for research leading to better understanding of the origin and distribution of mineral deposits. The products of field mapping and related research are known to have the highest priority with the Branch's main user, the exploration industry. The Branch also conducts, with the help of the Analytical Laboratory, the regional geochemical reconnaissance surveys that have proven very useful for both exploration and resource studies related to land use. The section under W. J. McMillan, mounted the main field projects listed in Table 2-2 with their distribution shown on Figure 2-2.

Budget estimates for the section included $511 638 in permanent salaries and $345 081 for field and all other costs. The Regional Geochemical Survey had a budget of $302 900, and grants to university projects had $70 000.

The geological studies conducted principally by project geologists were augmented by similar work by district geologists and laboratory scientists. Cooperative studies included: coal sampling—on Vancouver Island by G. E. P. Eastwood and in the Groundhog area by R. Gilchrist and A. Matheson, mapping—Barriere area by V. A. Preto and P. Schiarizza; mapping and mineral deposit studies—Cassiar area by A. Panteleyev and L. Diakow, Toodoggone area by T. Schroeter, A. Panteleyev, and L. Diakow, and in Kwadacha Park by D. MacIntyre and L. Diakow; lithogeochemical study—in Akie River area by D. MacIntyre and J. Lowey; several Project Geologists are also working jointly on studies, for example, T. Höy and D. MacIntyre on lead-zinc deposits in the Eastern Cordillera, and B. N. Church and G. E. P. Eastwood on fault definition using gravity methods.

Geoscience Projects Extension

The Regional Geochemical Survey in 1981 of Hope (92H), Ashcroft (92I), and Pemberton (92J) areas (*see* Fig. 2-2) was done by a series of separate contracts with planning supervision and control provided by the Branch. Considerable help in data handling was received from the Geological Survey of Canada.

Valuable additional work was also conducted by professors and graduate students at the University of British Columbia with the aid of grants from the Ministry. Many of these studies were directly relevant to Branch projects and some were cooperative. The university studies included:

Sinclair, A. J.: Multivariate Models for Relative Mineral Potential, Slocan Silver-Lead-Zinc-Gold Camp (82F).
Matysek, P., Sinclair, A. J., and Fletcher, W. K.: Rapid Anomaly Recognition and Ranking for Multi-element Regional Stream Sediment Surveys.
Andrew, A., Godwin, C. I., and Sinclair, A. J.: Preliminary Examination of Gold Metallogeny in the Insular Belt of the Canadian Cordillera using Galena-Lead Isotope Analyses.
Ross, John V. and Engi, Martin: Mantle Processes as Deduced from Alpine Ultramafics.
Linds, R. K.: Bowron River Progress Report.
Shen, K. and Sinclair, A. J.: Preliminary Results of a Fluid Inclusion Study of Sam Goosly Deposit, Equity Mines Ltd., Houston.
Carmichael, S. M. M.: Depositional Environments and Paleocurrent Trends in the Gates Member, Northeast Coalfield.

Isotopic analyses for the Branch were carried out by R. L. Armstrong and J. Harakal at the University of British Columbia. Other projects by staff of the University of Alberta, Queen's University, and Carleton University were also sponsored:

St. Louis, Robert M.: Platinoids in the Tulameen Ultramafic Complex (92H).
Journeay, J. Murray: Structural Setting along the Northwest Flank of Frenchman Camp Dome, Monashee Complex (82M/7).
Wittaker, Peter J.: Chromite Occurrences in Mitchell Range Ultramafic Rocks of the Stuart Lake Belt, Cache Creek Group (93N).

Progress in fieldwork of the Branch and related university projects is described yearly in *Geological Fieldwork*, published early in the year following the work, and in a series of preliminary maps, papers, and authoritative bulletins, issued irregularly. Those issued in 1981 are listed under "Publications."

Applied Programs

The work of the Applied Programs section, under the Manager, Applied Programs, includes aid in the field to exploration personnel and prospectors, monitoring of exploration and geological developments at producing mines, coal core storage and studies, prospector training, and mineral deposit land-use problems.

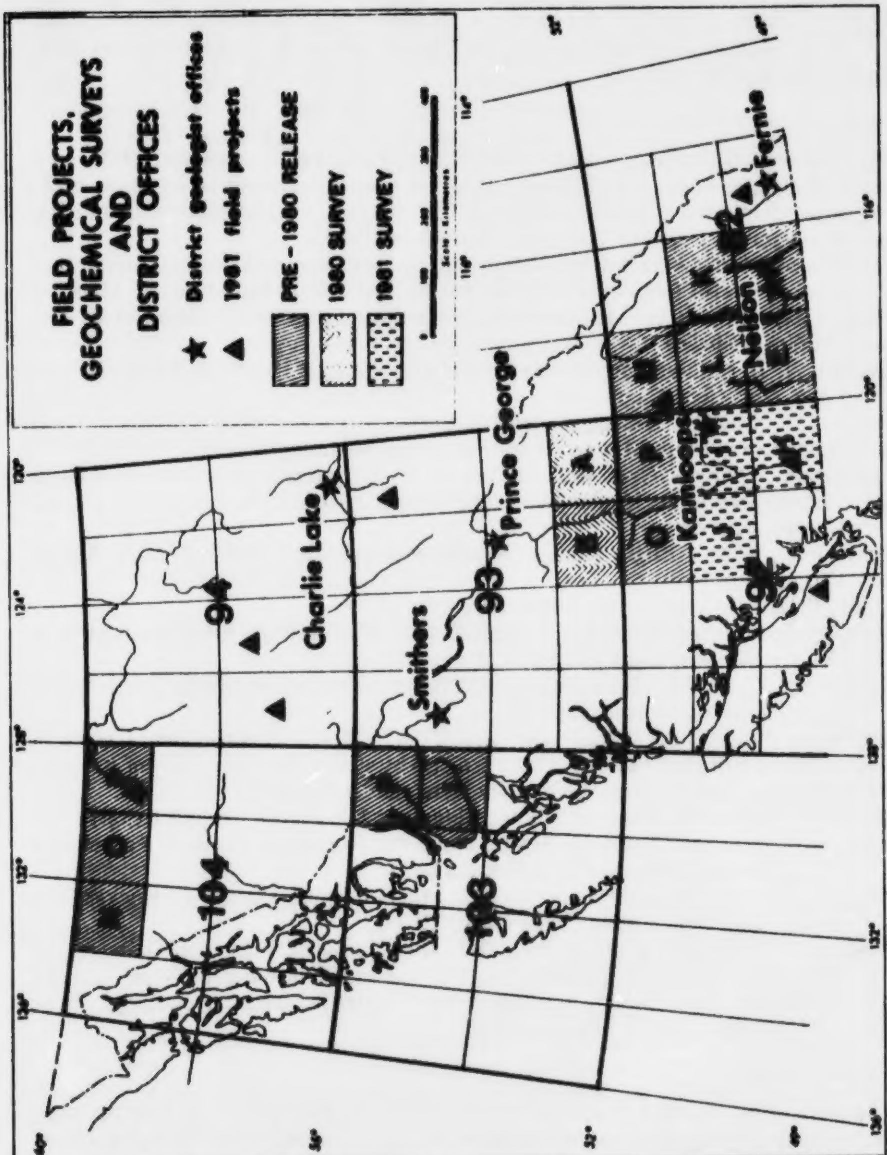
FIELD PROJECTS, GEOCHEMICAL SURVEYS AND DISTRICT OFFICES
★ District geologist offices
▲ 1981 field projects
PRE - 1980 RELEASE
1980 SURVEY
1981 SURVEY
Scale - Kilometres
0
100
200
300
400
Charlie Lake
Smithers
Prince George
Kamloops
Nelson
Fernie
94
93
104
103
92
82
60°
56°
52°
48°
136°
132°
128°
124°
120°
116°
114°

Figure 2.2

The multifaceted job of District Geologists is the principal vehicle by which Applied Programs are carried out. District Geologists are principally concerned in the monitoring and assistance of the mineral industry, the assessing of mineral properties and districts, and assisting and training prospectors under the *Mineral Prospectors Act*. In addition they carry out site examinations in regard to land use and represent the Ministry in regional resource committees. Four of the six district offices operated normally in 1981 but activity in the other two, in Fort St. John and Prince George, was seriously curtailed due to resignation of the incumbents. Highlights of the active districts include the following:

(1) T. G. Schroeter, Smithers, managed not only to visit properties all around the very active, large, northwestern district but also to lead in development exploration concepts of the Toodoggone gold-silver camp in cooperation with A. Panteleyev and L. Diakow.

(2) G. P. E. White, Kamloops, continued his field research on carbonatite deposits, and prospectors he has helped have successfully found and developed major prospects such as the Thanksgiving scheelite and the Top volcanogenic copper-silver properties.

(3) G. Addie, Nelson, was responsible for stimulating intense prospector activity in his district and the successful exploitation of small deposits.

(4) D. A. Grieve, Fernie, continued the field mapping of the Elk Valley Coalfield, coal quality studies including cooperation with B.C. Research and University of Victoria, and organized a most successful workshop on Crowsnest Coalfield in Fernie.

(5) G. V. White acted as District Geologist at Fort St. John, co-authored a paper on coal rank distribution in the Gething Formation with R. E. Karst, the former District Geologist, and returned to the University of British Columbia to complete his B.Sc. in geology.

A considerable part of the work of the section is devoted to training and aiding prospectors and small developers. Over 400 students were enrolled in basic prospecting courses in 1981 held in 15 localities, and 31 prospectors graduated from the 15-day-long Fifth Annual Mineral Exploration Course held at David Thompson University Centre, Nelson, under the joint sponsorship of the Ministry of Education, Selkirk College, and the Ministry of Energy, Mines and Petroleum Resources.

Staffing changes and shortages made 1981 a difficult year for Applied Programs. With the resignation of E. W. Grove, Manager of Applied Programs early in January 1981 to go into private practice, the section was left with only two permanent employees in the Victoria office—Joe Novak and Geri Dickson. Arrangements were made to temporarily fill the position by having Tom Schroeter, Gordon White, Gerry Klein, and Vic Preto act as Manager of Applied Programs. Miss Geri Dickson and the above ably directed the field offices and administered the *Mineral Prospectors Act* until the appointment of Fraser Shepherd as Acting Manager in March for the balance of 1981. In addition, R. E. Karst, Fort St. John, resigned in February and G. H. Klein, Prince George, in July, although he continued on contract to keep the office open one day a week for consultation.

Geological studies by District Geologists are described in *Geological Fieldwork, 1981* (Paper 1982-1).

The budget estimates for Applied Programs Section and Prospectors' Assistance were as follows: permanent salaries, $327 872; field and other costs, $202 944; Prospectors' Assistance training, $60 037; grants, $250 000.

Resource Data and Analysis

This section, under J. G. McArthur, is responsible for the collection, compilation, interpretation, distribution, and approval of exploration and development data gathered from various sources but principally from assessment reports and an annual survey of explorers. Most of the information is made generally available after requisite confidential periods, normally 1 to 3 years.

The major files are:

Mineral Assessment Reports—7 900 microfilmed reports available at reader/printers in Vancouver and Victoria.

Mineral Assessment Report Index—a computerized bibliographic index and map series updated annually.

MINFILE—a shallow level computerized information system with data on over 8 600 mineral occurrences; statistical data on mineral production and reserves; a companion to the Mineral Inventory Map Series.

Property Files—open files containing published and unpublished reports and maps (historical) on producers and prospects and filed by NTS.

Coal Assessment Reports—nearly 500 reports on coal exploration; nonconfidential files are available in Victoria.

Coal File—a computerized coal exploration data file is being constructed.

Mineral Deposit/Land Use Map Series—a series of interpretive mineral potential maps.

The annual volume, *Exploration in British Columbia*, is produced by the section coincident with its update of MINFILE.

In addition, the section administers the Portable Assessment Credit account, produces map compilations and mineral potential evaluation studies related to land-use conflicts, and advises on regulations. Field-oriented studies related to industrial minerals and structural materials are also handled by this section.

The results of a major field and office study of aggregate materials of the Lower Mainland and Vancouver Island were published by Z. D. Hora and F. C. Basham. A similar study of aggregates for other parts of the mainland is being compiled. New field programs for silica and barite were started.

Specific site investigations in regard to land-use assessments were carried out largely by District Geologists. The section actively participated on several land-use planning programs. The South Moresby and Slocan Valley planning programs were two of the most active.

The approximate budget of this section, distributed by function, was as follows: mineral inventory, $132 396; coal inventory, $84 506; industrial minerals, $73 005; mineral land use and resource analysis, $97 837; computers and consultants, $223 100; management, $41 812; total, $652 656. Of this total, $320 338 was for permanent staff salaries.

Analytical Laboratory

The Analytical Laboratory, under W. M. Johnson, is responsible for a complete range of analytical work in support of the projects of the Project Geologists and District Geologists of the Branch. It also provides analytical support for the Prospectors' Assistance Program and performs a limited number of free analyses for *bona fide* prospectors holding a valid free miner's licence. Some analytical work is performed for other Government agencies, and laboratory staff act as consultants on a wide range of topics for agencies, and laboratory staff act as consultants on a wide range of topics for agencies such as the Consumer Taxation Branch of the Ministry of Finance, the Ministry of Industry and Small Business Development, the Ministry of Highways, the Energy Resources Division of this Ministry, and various commercial and mining laboratories. The laboratory is also responsible for the standards used in the regional geochemical program and the quality control for that program as well as for assistance in its organization and administration. The Chief Analyst, in the capacity as Chairman of the Board of Examiners, is responsible for the certification of assayers in the province as specified in the *Ministry of Energy, Mines and Petroleum Resources Act* (sections 13 through 20).

The facilities of the laboratory include comminution and mineral separation equipment, X-ray fluorescence, atomic absorption, gamma-ray and emission spectrometric instruments, and an X-ray diffractometer. The laboratory is also capable of performing traditional fire assay and wet chemical analyses.

There was a significant amount of method development and research done in the laboratory during 1981 including the following:

Development of a New Method for the Determination of Barium in Rocks and Other Geological Materials by M. A. Chaudhry.

Development of Techniques for the Analysis of Coal Liquids by Paul Riehm, Ms. Kathy Colburn (auxiliary staff of this Ministry), and Dr. Paul West of the University of Victoria in close relationship with B.C. Research.

The Design and Construction of an Automatic Sample Changer to Make More Efficient the Increasingly Numerous Whole Rock Analyses Requested of the Laboratory by P. F. Ralph.

Continuing Development of Methodology for the Determination of Trace Elements Using X-Ray Fluorescence Techniques by Dr. V. Vilkos.

A Combined Field and Laboratory Study of the Mineralogy of the Tillicum Mountain Gold Deposit by Dr. J. Kwong in conjunction with G. Addie.

The Use of Recently Developed Statistical Techniques for the Evaluation of the Quality of the Data from the Regional Geochemical Survey by Dr. W. M. Johnson.

Participation in Interlaboratory Standard Reference Material Programs Including Supplying Sample Material for the Purpose by B. Bhagwanani, M. A. Chaudhry, Dr. W. M. Johnson, and P. F. Ralph.

Certification

There were five Certificates of Efficiency in Assaying awarded out of a total of seven candidates.

Output

Wet Chemical and X-Ray Fluorescence Laboratory: there were 1 729 results reported on 707 samples submitted by general prospectors and prospectors' assistance grantees as well as 8 847 results reported on 1 204 samples submitted by Ministry personnel.

Emission Spectrographic Laboratory: there were 35 698 semiquantitative determinations made on 1 215 samples and 1 499 quantitative results on 530 samples.

X-Ray Diffraction Laboratory: there were 744 mineral identifications made and 40 quantitative mineral determinations.

Mineral Separation: there were 76 mineral separates prepared for subsequent analytical work.

Sample Comminution: a total of 1 783 samples were received and prepared, 648 from prospectors and 1 135 from Ministry personnel.

The output of the laboratory was comparable with 1980, greater in some categories, less in others. Where decreases occurred they were roughly proportional to the decrease in geological staff caused by vacancies.

Budget

The laboratory's budget was $251 652 for permanent salaries, $51 500 for supplies and equipment, and $84 800 for travel, special services, temporary salaries, and miscellaneous.

Professional Activities

The staff of the Branch was active during 1981 in professional activities related to their work, including organizing and attending scientific meetings, field visits, and executive activities in societies.

During the year the staff played major roles in organizing four meetings and important roles in two others.

(1) Workshop on Southeastern British Columbia Coalfields at Fernie, February 11 and 12, organized by District Geologist D. A. Grieve at which 100 geologists from industry and government took park.

(2) Workshop on Computers and Coal at the Empress Hotel in Victoria, March 25 to 27, organized by Candace Kenyon at which 60 geologists took part.

(3) Meeting of the Committee of Provincial Geologists at the Delta Hotel, October 19, preceding the Mines Ministers' Conference.

(4) CIM District 6 Annual Meeting at the Empress Hotel and Newcombe Auditorium in which major organizational roles were played by J. G. McArthur, Secretary-Treasurer; A. Panteleyev, Technical Program Chairman; and W. J. McMillan, Tours and Services. A large number of staff were involved in organizing sessions or were speakers at this meeting. Attendance was over 700.

Two meetings to which staff also made important contributions were the Cordilleran Section of Geological Association of Canada Annual Meeting in February and Gold Symposium held in conjunction with the Society of Exploration Geochemists; both meetings in Vancouver.

Foreign travel for scientific and educational purposes or to stimulate exploration in British Columbia included the following:

(1) A. Panteleyev and T. G. Schroeter travelled in October to MacKay School of Mines, University of Nevada Invitational Research Conference on Zoning in Volcanic and Subvolcanic Mineral Deposits. Both gave papers.

(2) D. G. MacIntyre was an invited speaker at a symposium on Metals in Shales at the Geological Society of America in Cincinnati on November 1 and 2.

(3) W. M. Johnson represented the Ministry in a visit to laboratories and other facilities in Japan as part of the Canadian Coal Liquefaction Coordinating Committee in November.

(4) Z. D. Hora attended the Seventeenth Annual Forum on the Geology of Industrial Minerals held in May in Albuquerque, New Mexico.

(5) A. Sutherland Brown, J. G. McArthur, T. G. Schroeter, and G. P. E. White visited Northwest Mining Association Meeting in Spokane in December. A. Sutherland Brown organized and chaired a session, McArthur and Schroeter gave talks.

Staff involvement in professional affairs included the following:

Canadian Institute of Mining and Metallurgy: J. G. McArthur, Secretary-Treasurer of Victoria Section; A. Panteleyev, Past Chairman of Victoria Section.

Geological Association of Canada: W. J. McMillan, Chairman of Victoria Section; A. Panteleyev, councillor of Cordilleran Section and of Mineral Deposit Division.

Canadian Geoscience Council: A. Sutherland Brown, President elect and member of Committee of Provincial Geologists.

British Columbia Association of Professional Engineers: W. J. McMillan, councillor.

Analytical Chemistry Division of Chemical Institute of Canada: W. M. Johnson, Chairman.

Publications

The work of the Branch is presented to the interested public by a series of formal publications and maps, as well as by technical talks and informal discussions.

Formal publications prepared by the Division in 1981 include the following:

Papers:

Sand and Gravel Study, 1980, British Columbia Lower Mainland—a comprehensive review of aggregrates, by Z. D. Hora and F. C. Basham (Paper 1980-10).

Geological Fieldwork, 1981—a preliminary account of the work of the Branch presented as soon as possible after completion (Paper 1982-1).

Reconnaissance Rock Geochemistry of Nicola and Kingsvale Groups between Merritt and Princeton, by V. A. Preto (Paper 1981-2).

Bulletins

Bulletin 66—Berg Porphyry Copper-Molybdenum Deposit, Geological Setting, Mineralization, Zoning, and Pyrite Geochemistry, by Andrejs Panteleyev, 158 pp.

Bulletin 46—Late Glacial History and Surficial Deposits of the Okanagan Valley, by Hugh Nasmith, 54 pp. (Reprinted).

Preliminary Maps:

41—Geology of the Rock Creek Tertiary Outlier, by B. N. Church (parts of 82E/3E, 2W) (1:50 000).

42—Geology of the Crowsnest Coalfield, by D. E. Pearson and D. A. Grieve (part of 82G/7) (1:10 000).

43—Geology of Eastern Margin of Shuswap Complex, Frenchman Cap Area, by Trygve Höy and R. L. Brown (part of 82M) (1:100 000).

44—Geology of the Akie River Ba-Pb-Zn Mineral District, by D. MacIntyre (94F/6, 7, 10 11) (1:50 000, orthophoto base).

45—Geology of the Kelowna Tertiary Outlier, by B. N. Church (east half plus 13 and 14 of 82E) (1:50 000).

46—Geology of the Alpine-Boivin Carbonate-Hosted Zinc Occurrences, Rocky Mountain Front Ranges, Southeastern British Columbia, by G. Gibson (parts of 82G/14E and 82J/3E) (1:25 000).

47—Nicola Project, Merritt Area, by W. J. McMillan (parts of 92I/2f, 2g, 2h) (1:25 000).

Other Maps and Data Issued:

Regional Geochemical Surveys 5 and 6:

BC RGS-5, NTS 93A—Quesnel Lake.

BC RGS-6, NTS 93B—Quesnel.

Scale 1:250 000—13 elements in silts, 2 plus pH in water.

Mineral Deposit/Land Use maps, 92H Hope and 92I Ashcroft, by J. E. Forester.

Regularly updated maps and data in the following series are available:

Mineral Inventory Maps (issued as ozalid prints)—show location and commodities of all known mineral deposits.

Mineral Assessment Report Index Maps—show the location and number of reports accepted for assessment credit by the Ministry.

MINFILE—a revised and updated output of MINFILE made available during 1981.

Works published in external refereed and technical journals and for technical meetings in 1981 include the following:

BROWN, R. L., FYLES, J. T., GLOVER, J. K., HÖY, T., OKULITCH, A. V., PRETO, V. A., and READ, P. B.: Southern Cordillera Cross-Section, Cranbrook to Kamloops, Field Guides to Geology and Mineral Deposits, 1981 Annual GAC/MAC/CGU Meeting, Calgary, *Geol. Assn. Canada*, pp. 335–372.

CHURCH, B.N.: Volcanology, *Energy, Mines and Resources Canada*, Canadian Geophysical Bulletin, Vol. 33, 1980, pp. 122–131; Vol. 34, 1981, pp. 84–94.

HÖY, T., EDMUNDS, F. R., HAMILTON, J. M., HAUSER, R. L., MURARO, T. W., and RANSOM, P. W.: Lead-Zinc and Copper-Zinc Deposits in Southeast British Columbia, Field Guides to Geology and Mineral Deposits, 1981 Annual GAC/MAC/CGU Meeting, Calgary, *Geol. Assn. Canada*, pp. 41–67.

JOHNSON, W. M. and MAXWELL, J. A.: Rock and Mineral Analysis, 2nd Edition, A Wiley-Interscience Publication, Vol. 27, *John Wiley & Sons*, New York, 489 pp.

KOWALCHUK, J. M., CHURCH, B. N., BRADSHAW, P.M.D., and BARAKSO, J. J.: Lithogeochemistry at the Equity Silver Mine, *Western Miner*, April, 1984, pp. 50–54.

MCARTHUR, J. G.: Year Two in a Decade of Mineral Expansion in British Columbia, *Northwest Mining Assn.*, Proceedings, Spokane, Washington.

MCMILLAN, W. J.: Workshop on the Geology of Southeastern British Columbia Coalfields (Fernie, February), *Geoscience Canada*, Vol. 8, No. 3, pp. 130-131.

MCMILLAN, W. J. and JOHAN, Z.: Rock Geochemistry, Geology, and Genesis of the Guichon Creek Batholith, Proceedings, Symposium on Mineral Deposits of the Pacific Northwest, *U.S.G.S.*, Open File Report 81-355, pp. 84–105.

PEARSON, D. E. and CREANEY, STEPHEN: Reflectance of Carbonized Vitrinites as a Measure of Oxidation of a Coking Coal, *Fuel*, Vol. 60, No. 3, March 1981, pp. 273–275.

RALPH, P. F.: Automation System for Analytical Instruments, Proceedings, Thirteenth Annual Symposium and General Meeting (Cambrian College, Sudbury, October), *Canadian Mineral Analysts*, pp. 115–143.

TITLES DIVISION

The Titles Branch of the Mineral Resources Division is under the direction of the Chief Gold Commissioner and is responsible for the administration of the provincial laws relating to the acquisition of minerals and coal.

Staff

R. Rutherford	Chief Gold Commissioner
Vacant	Deputy Chief Gold Commissioner
D. Doyle	Gold Commissioner, Vancouver

Gold Commissioners and Sub-recorders are appointed for the 24 Mining Divisions throughout the province and their duties are specified in writing by the Chief Gold Commissioner.

Table 2-3—Gold Commissioners and Claims Inspectors

Mining Division	Phone	Location of Office	Name
Alberni	723-3501	4515 Elizabeth Street, Port Alberni V9Y 6L5	W. G. Mundell
Atlin	651-7577	Box 100, Atlin V0W 1A0	E. J. Johnstone
Cariboo	992-5591	102, 350 Barlow Avenue, Quesnel V2J 2C1	R. Campbell
Clinton	459-2268/69	Box 70, Clinton V0K 1K0	J. R. Frey
Fort Steele	489-3521	102—11th Avenue South, Cranbrook V1C 2P2	W. R. Anderson
Golden	344-5221/22	Box 39, Golden V0A 1H0	J. Olson
Greenwood	442-8642	Box 850, Grand Forks V0H 1H0	S. Matsuo
Kamloops	372-5233	Courthouse, Kamloops V2C 1E5	C. Kirk
Liard	387-1385	411 Douglas Building, Parliament Buildings, Victoria V8V 1X4	E. A. H. Mitchell
Lillooet	256-7548	Box 70, Lillooet V0K 1V0	R. E. Hall
Nanaimo	754-2111	Courthouse, Nanaimo V9R 5J1	I. Williams
Nelson	352-2211	310 Ward Street, Nelson, B.C. V1L 5S4	H. S. Tatchell
New Westminster	525-0375	100, 403, Sixth Street, New Westminster V3L 3B1	T. P. McKinnon
Nicola	378-6141	Box 339, Merritt V0K 2B0	L. P. Lean
Omineca	847-4411	Box 340, Smithers V0J 2N0	A. W. Milton
Osoyoos	493-1719	Courthouse, Penticton V2A 5A5	L. D. Sands
Revelstoke	837-3222	Box 380, Revelstoke V0E 2S0	D. G. B. Roberts
Similkameen	295-6957	Box 9, Princeton V0X 1W0	W. L. Marshall
Skeena	624-2121	Courthouse, Prince Rupert V8J 1B7	Vacant
Slocan	353-2219	Box 580, Kaslo V0G 1M0	Mrs. J. James
Trail Creek	362-7324	Box 910, Rossland V0G 1Y0	A. D. Sherwood
Vancouver	668-2672	800 Hornby Street, Vancouver V6Z 2C5	D. Doyle
Vernon	545-2387	Courthouse, Vernon V1T 4W5	N. A. Nelson
Victoria	387-1385	411 Douglas Building, Parliament Buildings, Victoria V8V 1X4	E. A. H. Mitchell

Claims Inspectors

D. Lieutard, 401, 350 Barlow Avenue, Quesnel V2J 2C1 992-5591—Local 260
T. Jones, Box 877, Smithers V0J 1N0 847-4411—Local 278
R. Conte, 800 Hornby Street, Vancouver V6Z 2C5 668-2672
H. S. Turner, 212, 2985 Airport Drive, Kamloops V2B 7W8 376-7201
D. Moule, 403 Vernon Street, Nelson V1L 4E6 352-2211—Local 303

The recording of locations and of work on mineral claims as required pursuant to the provisions of the *Mineral Act*, and the recording of work on placer leases as required under the *Mining (Placer) Act*, must be made at the office of the Gold Commissioner for the Mining Division in which the claim or lease is located. The statistics for the Gold Commissioner's office are shown on Table 2-4.

Central Records Office (Victoria and Vancouver)

Copies of records of mineral claims and 2-post claims recorded in the office of Gold Commissioners are forwarded to the office of the Chief Gold Commissioner daily, while transcripts of all other recording in the offices of the Gold Commissioners are sent twice monthly.

Information concerning claims and leases and the ownership and standing of claims and leases in any Mining Division may be obtained from the Gold Commissioner for the Mining Division in which the property is situated or from the Ministry's offices, Room 411, Douglas Building, Victoria, and 800 Hornby Street, Vancouver, the office of the Gold Commissioner.

The records and maps, showing the approximate positions of mineral claims held by record and of placer leases, may be viewed by the public during regular office hours in Victoria, and at the office of the Gold Commissioner in Vancouver. The position of mineral claims held by record and of placer leases is plotted from details supplied by the locators. Prints of mineral and placer titles reference maps at a scale of 1:50 000 may be obtained from the Victoria and Vancouver offices.

Appointed officials in the office of the Gold Commissioner at Victoria and the Gold Commissioner at Vancouver act as Sub-recorders for all Mining Divisions.

Table 2-4—Gold Commissioner's Office Statistics

Mining Division	Free Miners' Certificate		Lode Mining						Placer Mining					Revenue		
	Individual	Company	Mineral Claims Units	Work Numbers	Cash in Lieu	Bills of Sale	Mining Leases	Lease Rentals	Lease Issued	Work Numbers	Cash in Lieu	Bills of Sale	Extensions	Free Miners' Certificates	Mining Receipts	Total
					$			$			$			$	$	$
Alberni	109	4	1 712	4 577	20 900	72	....	5 244	......	12	....	....	....	1 745	67 884.00	69 629.00
Atlin	637	9	4 729	9 839	63 800	36	....	572	238	688	18 300	79	8	5 885	192 189.00	198 074.00
Cariboo	3 054	43	10 130	10 880	38 390	143	....	9 544	1 045	1 678	18 900	363	27	29 190	360 238.00	389 428.00
Clinton	115	4	2 513	13 814	22 440	32	....	104	28	112	9 300	14	1	1 775	118 816.00	120 591.00
Fort Steele	530	5	3 736	8 217	29 810	32	....	2 592	63	128	600	11	1	4 150	102 490.00	106 640.00
Golden	166	7	617	10 612	45 540	24	....	1 078	4	......	900	....	....	2 930	153 735.00	156 665.00
Greenwood	176	2	1 0[illegible]	9 031	33 000	108	....	4 648	16	45	900	10	3	1 480	92 946.00	94 426.00
Kamloops	951	24	4 9[illegible]	20 089	73 810	153	1	6 560	7	34	2 400	....	2	11 935	234 046.00	245 981.00
Liard	600	1	6 013	27 689	126 940	88	....	6 184	132	286	22 200	76	8	3 300	417 895.00	421 195.00
Lillooet	164	3	2 870	7 369	59 510	68	....	2 552	29	82	1 200	4	3	1 720	135 901.00	137 621.00
Nanaimo	544	12	1 674	5 522	42 570	38	....	824	7	......	....	....	....	6 325	103 276.00	109 601.00
Nelson	554	6	1 967	6 066	33 770	102	....	952	23	30	....	4	4	4 865	91 697.00	96 562.00
New Westminster	1 270	35	1 710	7 632	42 130	51	....	1 920	36	77	1 500	2	4	18 050	107 085.00	125 135.00
Nicola	134	......	1 620	6 501	14 740	48	....	602	......	......	....	....	....	730	59 150.00	59 880.00
Omineca	606	15	7 841	35 962	108 790	123	....	22 396	183	153	1 800	58	12	7 530	496 735.00	504 265.00
Osoyoos	291	13	975	4 010	65 230	35	....	7 074	......	......	....	....	....	5 355	104 042.00	109 397.00
Revelstoke	178	9	1 958	5 406	56 980	47	....	646	9	37	....	13	....	3 590	92 585.00	96 175.00
Similkameen	243	1	1 362	6 631	35 970	61	....	4 476	74	201	2 100	53	8	1 515	97 042.00	98 557.00
Skeena	354	4	6 039	25 891	97 350	101	....	3 922	6	7	....	1	2	2 970	281 765.00	284 735.00
Slocan	256	15	2 846	10 209	49 830	142	....	5 977	......	4	....	1	....	5 780	154 317.00	160 097.00
Trail Creek	88	2	213	1 583	4 510	3	....	482	......	......	....	....	....	1 040	13 933.00	14 973.00
Vancouver	3 546	780	2 740	5 431	22 000	46	....	1 972	......	......	....	....	....	251 730	121 742.00	373 472.00
Vernon	637	14	1 274	3 328	18 700	25	....	654	33	65	....	2	5	7 385	36 306.00	43 691.00
Victoria	1 057	153	1 050	1 741	5 170	17	....	80	13	74	600	4	3	51 185	110 194.00	161 379.00
Total 1981	16 260	1 161	71 667	248 030	1 111 880	1 595	1	91 055	1 946	3 713	80 700	695	91	432 160	3 746 009.00	4 178 169.00
Total 1980	18 840	994	72 349	141 142	1 001 330	1 507	5	111 370	763	2 420	113 000	443	143	391 145	2 935 323.46	3 492 634.93

Mineral and Placer Title Maps

The initial program of redrawing mineral titles reference maps which are produced for the public on a scale of 1:50 000 was completed in 1977 and the entire province is now available at this scale.

Two thousand four hundred and fifty five applications were received for placer leases under a new system, established in 1975 with the proclamation of a new *Mining (Placer) Act*, of only accepting applications for leases in designated placer areas.

There were 43 requests for the designation of additional areas under the *Mining (Placer) Act*.

Mineral Claims Inspectors are based at Kamloops, Smithers, Vancouver, Quesnel and Nelson. Their duties include checking the locations of mineral claims to correlate them with the plotted position of the claims, determining the validity of the staking under the *Mineral Act* and the *Mining (Placer) Act* and Regulations, investigations of possible misuse of mineral claims, and investigations of disputes. In order to fulfill the objectives of providing claim-holders with firm titles and maintaining accurate and up-to-date records, the activities of the inspectors have increased with the use of the modified grid system and also as a result of the continued high volume of applications for placer leases.

During 1981 as a result of 35 complaints under section 50 (formerly section 80) of the *Mineral Act*, 6 mineral claims were cancelled.

The Gold Commissioner's office in Vancouver is now equipped with a microfilm reader which will allow the general public to view technical reports. The Xerox machine will print these reports at a nominal cost. The Vancouver office should now become a greater source of information for the mining community.

Coal

The Coal Administrator is responsible to the Chief Gold Commissioner for the daily administration of the *Coal Act*. This involves reviewing applications for coal licences and leases and maintenance of records of title.

The statistics related to coal licences for 1981 are shown in Table 2-5.

Table 2-5—Statistics for Coal Licences, 1981

Number of coal licence applications	623
Approximate areas of coal licence applications	170 139 hectares
Number of coal licences issued	498
Approximate area of coal licences issued	133 654 hectares
Annual rental	$3 025 836.00
Application fees	$ 6 230.00
Cash in lieu of work	$ 94 971.18
Miscellaneous fees	$ 1 715.00

MINERAL ECONOMICS BRANCH

Objectives and Organization

The Branch provides economic, financial, and statistical analyses pertaining to provincial mineral sector policy, legislation, and planning, and also collects, maintains, and disseminates comprehensive statistical data in support of Ministry resource management responsibilities. These major objectives are further delineated as follows:

(1) the provision of expertise on the economic aspects of mineral sector policy and planning including assistance on the formulation of incentive programs, infrastructure support programs, taxation and tenure systems, appropriate evaluation frameworks, and provincial and intergovernmental mineral policies;

(2) the conduct of selected mineral industry economic analyses including marketing, supply, financial, economic and fiscal evaluations of mineral projects and government programs, and environmental-economic and socio-economic assessments; and

(3) the collection, maintenance, and dissemination of comprehensive British Columbia mineral industry statistics for use by the Branch, the Ministry, and other users, covering producing metal, coal, industrial minerals, structural materials, and placer operations, and associated production, sales, and values of commodities produced from these operations.

The Mineral Economics Branch is currently organized under the Director into four groups—an administrative support group, an economic and financial analysis group, a mineral policy group, and a mineral statistics group.

Staff

The staff of the Branch, as of December 31, 1981, was as follows:

Director (acting)	J. F. Clancy
Economic and Financial Analysis—	
Senior Economic Analyst (temporary auxiliary)	L. Nutter
Senior Financial Analyst	P. Monier
Mineral Statistics—	
Senior Mining Statistician	W. Wilson
Research Officer	K. Brueckl
Clerk V	K. Dornan
Clerk V	Barbara MacDonald
Mineral Policy—	
Senior Policy Analyst	L. Pan
Administrative Support—	
Office Manager	Josephine Harris
Office Assistant	Signy Thorleifson

During the year Frank Basham resigned as Branch Director to become the Federal Trade Commissioner in Canberra, Australia. John Clancy, the Senior Economic Analyst, was appointed Acting Director in September.

Newcomers to the Branch in 1981 were Leigh Pan, Klaus Brueckl, Linda Nutter and Ron Rayner. With the appointment of L. Pan in October as Senior Mineral Policy Analyst, the capability of the Branch to work on policy-related matters was greatly enhanced.

Klaus Brueckl joined the Mineral Statistics group on July 6th. He is expected to play an important role in the ongoing development of improvement of the data storage and analysis methods.

Linda Nutter was hired in September on a temporary auxiliary basis to fill in for John Clancy as Senior Economic Analyst. She is expected to continue in this position until the permanent Director is appointed.

University of Victoria student, Ron Rayner, was another temporary member of the group. His assignment was to examine the outlook for barite production in British Columbia.

Review of Activities

Major activity areas for the Branch during the year included the evaluation of new coal and metal projects under the *Guidelines for Coal Development* and *Procedures for Approval of Metal Mine Development*, pursuant to infrastructure assistance and benefit cost analysis of prospective coal and metal projects in several regions. Concurrent with these evaluations, efforts were also directed toward refining and updating COALMOD and MINSIM, the Ministry's computerized financial and economic evaluation systems for coal and metal mining projects respectively.

The Branch carries out research and analysis and prepares reports, briefing documents and Cabinet Submissions on a wide range of topics. Among the papers completed by the Economics and Financial Analysis group this year were:

'Western Business Outlook—Mineral Sector'

'Mineral Sector Indicators for British Columbia'

'Sand and Gravel Study' prepared in conjunction with the Geological Branch

'The Outlook for Barite Production in British Columbia'.

The following papers were produced by the Mineral Policy group:

'Fuel Requirements of a 25 MW Power Plant in the Queen Charlotte Islands'

'Common Interest and Potential Conflict Regarding the Slocan Valley Planning Program'

'Outlook for Processing of Metallic Minerals in British Columbia'

'An Action Plan on Strategic Regional Planning for Mineral Resource Development'.

This year British Columbia played host to the Annual Mines Ministers' Conference, held October 19th–21st at the Empress Hotel. The Mineral Economics Branch was directly involved in organizing the Conference, briefing the Minister, and overseeing the registration process.

An important achievement this year was the expansion of the Exploration and Development Survey to include physical parameters along with the financial data. This represents a considerable streamlining of the reporting requirements placed on the mining companies, since physical information was previously collected on a separate basis.

Staff of the Branch continued to provide information on mineral policy and project planning to domestic and foreign groups of investors, buyers and other parties. Discussions ranged from general policy matters, to coal market potential, and mineral processing and fabricating opportunities in British Columbia.

The mineral statistics group's activity during the year included assembly and dissemination, on a monthly and annual basis, the survey, collection, editing and compilation of all mineral production activity and data for the province. Staff in the group participate regularly in joint consultative efforts with other governments to streamline the data collection process and improve the accuracy and validity of mineral statistical reports. The Branch completed its planning and programming for computerization of the monthly metal mine surveys, through the MINSTATS project. This work has resulted in a much improved and more timely statistical reporting system.

Mineral Resource Statistics

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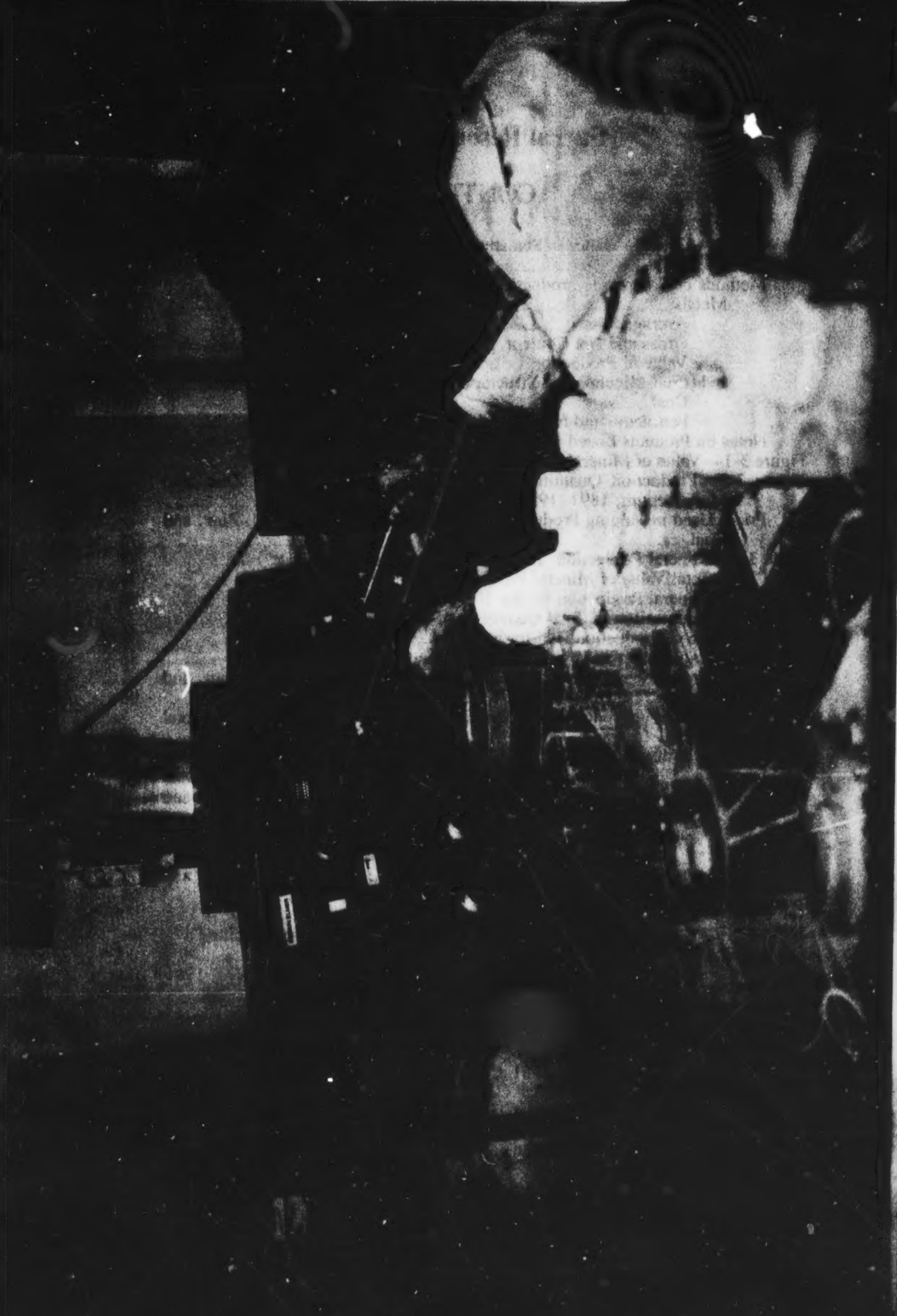

INTRODUCTION

The statistics of the mineral industry are collected, compiled, and tabulated for this Report by the Mineral Economics Branch of the Mineral Resources Division.

In the interests of uniformity and to avoid duplication of effort, beginning with the statistics for 1925, Statistics Canada and the provincial ministries have cooperated in collecting and processing mineral statistics.

Producers of metals, industrial minerals, structural materials, coal, and petroleum and natural gas are requested to submit returns in duplicate on forms prepared for use by the province and by Statistics Canada.

As far as possible, both organizations follow the same practice in processing the data. The final compilation by Statistics Canada is usually published considerably later than the *Annual Report of the Ministry of Energy, Mines and Petroleum Resources* for British Columbia. Differences between the values of production published by the two organizations arise mainly because Statistics Canada uses average prices considered applicable to the total Canadian production, whereas the British Columbia mining statistician uses prices considered applicable to British Columbia production.

Peat, classified as a fuel by Statistics Canada, is not included in the British Columbia statistics of mineral production, being regarded as neither a fuel nor a mineral.

The statistics of the petroleum industry are collected, compiled, and tabulated for this Report by the Petroleum Resources Branch. They are included here for comparative purposes.

METHODS OF COMPUTING PRODUCTION

The tabulated statistics are arranged so as to facilitate comparison of the production records for the various mining divisions, and from year to year. From time to time, revisions have been made to figures published in earlier reports as additional data became available or errors became known.

Data are obtained from the certified returns made by the producers of metals, industrial minerals and structural materials, and coal, and are augmented by data obtained from custom smelters. For petroleum, natural gas, and liquid by-products, production figures supplied by the Petroleum Resources Branch of the Ministry of Energy, Mines and Petroleum Resources are compiled from the monthly disposition reports and the Crown royalty statement filed with the Ministry by the producers.

Values are in Canadian funds. Metric weights are used throughout.

METALS

AVERAGE PRICES

The prices used in the valuation of current and past production of gold, silver, copper, lead, and zinc are shown in the table on page 75.

Prior to 1974 the price of gold used was the average Canadian Mint buying-price for fine gold.

The price used for placer gold originally was established arbitrarily at $17 per ounce, when the price of fine gold was $20.67 per ounce. Between 1931 and 1962 the price was proportionately increased with the continuously changing price of fine gold. Since 1962, Canadian Mint reports giving the fine-gold content have been available for all but a very small part of the placer gold produced, and until 1973 the average price listed is derived by dividing ounces of placer gold into total amount received. Starting in 1974 the price used for the valuation of gold, lode and placer, is the amount received by the producer.

Prior to 1949 the prices used for silver, copper, lead and zinc were the average prices at the markets indicated in the table on page 75, converted into Canadian funds. The abbreviations in the table are Mont. = Montreal; N.Y. = New York; Lon. = London; E. St. L. = East St. Louis; and U.S. = United States.

Starting in 1949 the price of silver, copper, lead, and zinc were average United States prices converted into Canadian funds. Average monthly prices were supplied by Statistics Canada from figures published in the Metal Markets section of *Metals Week*. Specifically, for silver it was the New York price; for lead it was the New York price; for zinc it was the price at East St. Louis of Prime Western; for copper it was the United States export refinery price. Commencing in 1970 the copper price is the average of prices received by the various British Columbia shippers and since 1974 this applies also to gold, silver, lead, zinc, and cadmium.

For antimony and bismuth the average producers' price to consumers is used. For nickel the price used is the Canadian price set by Inco Limited. The value per tonne of the iron ore used in making pig iron at Kimberley was an arbitrary figure, being the average of several ores of comparable grade at their points of export from British Columbia.

GROSS AND NET CONTENT

The gross content of a metal in ore, concentrate, or bullion is the amount of the metal calculated from an assay of the material, and the gross metal contents are the sum of individual metal assay contents. The net contents are the gross contents less smelter and refinery losses.

In past years there have been different methods used in calculating net contents, particularly in the case of one metal contained in the concentrate of another. The method established in 1963 is outlined in the following table. For example, the net content of silver in copper concentrates is 98 per cent of the gross content, of cadmium in zinc concentrates is 70 per cent of the gross content, etc. Commencing in 1974 the quantities represent the actual net quantities of metals paid for.

	Lead Concentrates	Zinc Concentrates	Copper Concentrates	Copper-Nickel Concentrates	Copper Matte
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Silver	98	98	98	...	98
Copper	*Less* 26 lb./ton	...	*Less* 10 lb./ton	85	*Less* 10 lb./ton
Lead	98	50	...	...	50
Zinc	50	90	...	...	...
Cadmium	...	70	...	...	...
Nickel	...	...	...	88	...

VALUE OF PRODUCTION

For indium, iron concentrate, mercury, molybdenum, rhenium, and tin the value of production is the amount received by the shippers.

For gold, silver, copper, lead, zinc, antimony, bismuth, cadmium, some iron concentrate, and nickel the value of production was calculated from the assay content of the ore, concentrate, or bullion less appropriate smelter losses, and an average price per unit of weight. Since 1974 the values represent the settlement values received by the producers for the respective metals.

Prior to 1925 the value of gold and copper produced was calculated by using their true average prices and, in addition, for copper the smelter loss was taken into account.

The value of other metals was calculated from the gross metal content of ores or concentrates by using a metal price which was an arbitrary percentage of the average price, as follows: silver, 95 per cent; lead, 90 per cent; and zinc, 85 per cent.

It is these percentages of the average price that are listed in the table on page 75.

For 1925 to 1973 the values had been calculated by using the true average price (*see* page 75) and the net metal contents in accordance with the procedures adopted by Statistics Canada and the Ministry of Energy, Mines and Petroleum Resources.

Since 1974 the total quantity and value of metal production include the quantities paid for to the mines, and the smelter and refinery production that can be attributed to the mines but is not paid for. The quantity and value paid for to the mines, excluding outward transportation costs, smelting and refining costs, penalties and deductions, are shown separately for comparative purposes.

INDUSTRIAL MINERALS AND STRUCTURAL MATERIALS

The values of production of industrial minerals and structural materials are approximately the amounts received at the point of origin.

COAL

The value of production of coal is calculated using a price per tonne which is the weighted average of the f.o.b. prices at the mine for the coal sold.

PETROLEUM AND NATURAL GAS

The values of production of natural gas, natural gas liquid by-products, and petroleum including condensate/pentanes plus are the amounts received for the products at the well head.

NOTES ON PRODUCTS LISTED IN THE TABLES

Antimony—Antimony metal was produced at the Trail smelter from 1939 to 1944; since 1944 it has been marketed alloyed with lead. The antimony is a by-product of silver-lead ores. In 1907 the first recorded antimonial ore mined in British Columbia was shipped from the Slocan area to England. Since then other out-of-province shipments have originated in the Bridge River, North Lardeau, Slocan, Spillimacheen, and Stuart Lake areas. In Table 3-7C the antimony assigned to individual mining divisions is the reported content of ore exported to foreign smelters; the antimony "not assigned" is that recovered at the Trail smelter from various ores received there. *See* Tables 3-1, 3-3, and 3-7C.

Arsenious oxide—Arsenious oxide was recovered at foreign smelters from arsenical gold ores from Hedley between 1917 and 1931, and in 1942, and from the Victoria property on Rocher Déboulé Mountain in 1928. No production has been recorded since 1942. *See* Tables 3-1 and 3-7D.

Asbestos—British Columbia has produced asbestos since 1952 when the Cassiar mine was opened. All British Columbia production consists of chrysotile from the Cassiar mine near the Yukon boundary. This deposit is noted for its high percentage of valuable long fibre and for the low iron content of the fibre. The original claims were located at Cassiar in 1950, and the first fibre was shipped two years later. The fibre is milled from the ore at Cassiar and now most is shipped by truck to Stewart. From 1953 to 1961 the fibre was valued at the shipping point in North Vancouver, but beginning in 1962 it has been valued at the mine, and values for the preceding years have been recalculated on that basis. *See* Tables 3-1, 3-3, and 3-7D.

Barite—Barite production began in 1940 and has been continuous since then, coming from several operations in the upper Columbia River valley. Some barite has been mined from lode deposits and the rest recovered from the mill-tailings ponds of the former Silver Giant and Mineral King silver-lead-zinc mines. *See* Table 3-7D.

Bentonite—Small amounts of bentonite were produced between 1926 and 1944 from deposits in the coal measures near Princeton. There has been no production since 1944. *See* Tables 3-1 and 3-7D.

Bismuth—Since 1929 the Trail smelter has produced bismuth. It is a by-product of lead refining and thus the production cannot be assigned to specific properties or mining divisions. *See* Tables 3-1, 3-3, and 3-7C.

Brick—*See* Clay and shale products.

Building-stone—Dimensional stone for building purposes is quarried when required from a granite deposit on Nelson Island and an andesite deposit on Haddington Island. Other stone close to local markets is quarried periodically or as needed for special building projects. *See* Tables 3-1, 3-3, and 3-7E.

Butane—Butane is recovered as a by-product at the gas-processing plant at Taylor and at oil refineries. *See* Tables 3-1, 3-3, and 3-7A.

Cadmium—Cadmium has been recovered as a by-product at the Trail zinc refinery since 1928. It occurs in variable amounts in the sphalerite of most British Columbia silver-lead-zinc ores. In Table 3-7C the cadmium assigned to individual mining divisions is the reported content of custom shipments to the Trail and foreign smelters; that "not assigned" is the remainder of the reported estimated recovery at the Trail smelter from British Columbia concentrates. *See* Tables 3-1, 3-3, and 3-7C.

Cement—Cement is manufactured from carefully proportioned mixtures of limestone, gypsum, and other mineral materials. It has been produced in British Columbia since 1905. Present producers are Inland Cement Industries Ltd., with a 907 180-tonnes-per-year plant on Tilbury Island, and a 490 000-tonnes-per-year plant at Bamberton, and Canada Cement Lafarge Ltd., with a 476 000-tonnes-per-year plant on Lulu Island and a 191 000-tonnes-per-year plant at Kamloops. *See* Tables 3-1, 3-3, and 3-7E.

Chromite—Two shipments of chromite are on record, 608 tonnes from Cascade in 1918 and 114 tonnes from Scottie Creek in 1929. *See* Tables 3-1 and 3-7C.

Clay and shale products—These include brick, blocks, tile, pipe, pottery, lightweight aggregate, and pozzolan manufactured from British Columbia clays and shales. Common red-burning clays and shales are widespread in the province, but better grade clays are rare. The first recorded production was of bricks at Craigflower in 1853 and since then plants have operated in most towns and cities for short periods. Local surface clay is used at Haney to make common red brick, tile, and flower pots. Shale and fireclay from Abbotsford Mountain are used to make firebrick, facebrick, sewer pipe, flue lining, and special fireclay shapes in plants at Kilgard, Abbotsford, and South Vancouver. A plant at Quesnel makes pozzolan from burnt shale quarried south of Quesnel. Several hobby and art potteries and a sanitary-ware plant are in operation, but these use mainly imported raw materials and their production is not included in the tables. *See* Tables 3-1, 3-3, and 3-7E.

Coal—Coal is almost as closely associated with British Columbia's early history as is placer gold. Coal was discovered at Suquash on Vancouver Island in 1835 and at Nanaimo in 1850. The yearly value of coal production passed that of placer gold in 1883 and contributed a major part of the total mineral wealth for the next 30 years.

First production, by mining divisions: Cariboo, 1942; Fort Steele, 1898; Kamloops, 1893; Liard, 1923; Nanaimo, 1836; Nicola, 1907; Omineca, 1918; Osoyoos, 1926; Similkameen, 1909; and Skeena, 1912.

The Nanaimo and Comox fields produced virtually all of the coal until production started from the Crowsnest field in 1898. The Crowsnest field contains coking coal and prospered in the early years of smelting and railroad building. Mining started in the Nicola-Princeton Coalfield in 1907, at Telkwa in 1918, and on the Peace River in 1923. The Nanaimo field was exhausted in 1953 when the last large mines closed, and only small operations on remnants were left. The colliery at Merritt closed in 1945 and at Coalmont in 1940. The closing of the large mine at Tsable River in 1966, and the last small one, near Wellington in 1968, marked the end of continuous production from the important Vancouver Island deposits. Recent exploration indicates the possibility of renewed coal mining on the island.

Undeveloped fields include basins in the foothills of the Rocky Mountains south of the Peace River, the Groundhog basin in north-central British Columbia, the Hat Creek basin west of Ashcroft, and Sage Creek basin southeast of Fernie.

The enormous requirements for coking coal in Japan created intense exploration in various areas of British Columbia since 1968. The signing of large contracts with the Japanese resulted in preparations for production at several deposits in the East Kootenays. First shipments to Japan via special port facilities at North Vancouver and Roberts Bank began in 1970.

All the coal produced, including that used in making coke, is shown as primary mine production. Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. From 1910 the quantity is the amount sold and used, which includes sales to retail and wholesale dealers, industrial users, and company employees; coal used under company boilers, including steam locomotives; and coal used in making coke. *See* Tables 3-1, 3-3, 3-7A, 3-8A, and 3-8B.

Cobalt—In 1928 a recovery of 1,730 pounds of cobalt was made from a shipment of arsenical gold ore from the Victoria mine on Rocher Déboulé Mountain. From 1971 to 1973, cobalt was shipped from the Pride of Emory mine at Hope. *See* Tables 3-1 and 3-7C.

Coke—Coke is made from special types of coal. It has been produced in British Columbia since 1895. Being a manufactured product, its value does not contribute to the total mineral production as shown in Table 3-1. Up to 1966, coke statistics had been included in the Annual Report at Table 3-9, but this table has been discontinued. The coal used in making coke is still recorded in Table 3-8B.

Condensate—(a) *Field*—Field condensate is the liquid hydrocarbons separated and recovered from natural gas in the field before gas processing. (b) *Plant*—Plant condensate is the hydrocarbon liquid extracted from natural gas at gas-processing plants. *See* Tables 3-1, 3-3, and 3-7A.

Copper—From 1935 to 1978 no copper smelter operated in British Columbia and most of the copper concentrates were shipped to Japanese, eastern Canadian, and American smelters. In 1978, Afton Mines Ltd. started producing blister copper from its own concentrates. Most of the smelting in British Columbia in early years was done on ore shipped directly from the mines without concentration, but modern practice is to concentrate the ore first. Small amounts of gold and silver are commonly present and add value to the ore.

Ore was smelted in British Columbia first in 1896 at Nelson (from Silver King mine) and at Trail (from Rossland mines), and four and five years later at Grand Forks (from Phoenix mine) and Greenwood (from Mother Lode mine). Later, small smelters were built in the Boundary district and on Vancouver and Texada Islands, and in 1914 the Anyox smelter was blown in. Copper smelting ceased in the Boundary district in 1919, at Trail in 1929, and at Anyox in 1935. British Columbia copper concentrates were then smelted mainly at Tacoma, and since 1961 have gone chiefly to Japan.

Most of the production has come from southern British Columbia—from Britannia, Copper Mountain, Greenwood, Highland Valley, Merritt, Nelson, Rossland, Texada Island, and Vancouver Island, although a sizable amount came from Anyox and some from Tulsequah. During the 1960's, exploration for copper became intense, interest being especially directed toward finding very large, low-grade deposits suitable for open-pit mining. The activity has resulted in the establishment of operating mines at Merritt (Craigmont) in 1961, in Highland Valley (Bethlehem) in 1962, on Babine Lake (Granisle) in 1966, near Peachland (Brenda) in 1970, Stewart (Granduc)—closed mid-1978 but reopened in late 1980, near Port Hardy (Island Copper) in 1971, near Babine Lake (Bell), McLeese Lake (Gibraltar), Highland Valley (Lornex), Princeton (Ingerbelle) in 1972, and near Kamloops (Afton) in 1977. *See* Table 3-12 for a complete list of copper producers. The Highmont mine in the Highland Valley commenced shipments in 1981.

Some of these mines produce molybdenum as a by-product, for example, Bethlehem, Brenda, Highmont, Lornex, Gibraltar, and Island Copper. Copper is also produced as a by-product of iron mining as Tasu Sound, Queen Charlotte Islands (Wesfrob), and with ores containing zinc, gold, silver, lead, and cadmium, at Buttle Lake (Lynx and Myra, Western Mines).

Copper has been the most valuable single commodity of the industry since 1966 except in 1977, 1979 and 1981 when it was surpassed marginally by natural gas. *See* Tables 3-1, 3-3, 3-6, and 3-7B.

Crude oil—Production of crude oil in British Columbia began in 1955 from the Fort St. John field, but was not significant until late in 1961, when the oil pipeline was built to connect the oil-gathering terminal at Taylor to the Trans Mountain Oil Pipe Line Company pipeline near Kamloops.

In Tables 3-1, 3-3, and 3-7A, quantities given prior to 1962 under "petroleum, crude" are total sales, but since 1962 the field and plant condensates are listed separately. Table 3-14 incorporates all revisions since the commencement of production.

Diatomite—Relatively large deposits of diatomite are found near the Fraser River in the Quesnel area, and small deposits are widespread throughout the province. Small amounts of diatomite have been shipped from Quesnel periodically since 1928. A plant to process the material is located in Quesnel. *See* Table 3-7D.

Fluorite (fluorspar)—Between 1918 and 1929, fluorite was mined at the Rock Candy mine north of Grand Forks for use in the Trail lead refinery. From 1958 to 1968, small quantities were produced as a by-product at the Oliver silica quarry. *See* Table 3-7D.

Flux—Silica and limestone are added to smelter furnaces as flux to combine with impurities in the ore and form a slag which separates from the valuable metal. In the past, silica was shipped from Grand Forks, Oliver, and the Sheep Creek area. Today, silica from near Kamloops and limestone, chiefly from Texada Island, are produced for flux. Quantities have been recorded since 1911. *See* Tables 3-1, 3-3, and 3-7D.

Gold, lode—Gold has played an important part in mining in the province. The first discovery of lode gold was on Morseby Island in 1852, when some gold was recovered from a small quartz vein. The first stamp mill was built in the Cariboo in 1876, and it seems certain that some arrastras (primitive grinding mills) were built even earlier. These and other early attempts were short-lived, and the successful milling of gold ores began about 1890 in the southern part of the province. By 1900 the value of gold production was second only to that of coal. At the start of World War II, gold mining attained a peak yearly value of more than $22 million, but since the war it has dwindled until developments in the 1970s.

In the early years, lode gold came mostly from the camps of Rossland, Nelson, McKinney, Fairview, Hedley, and also from the copper and other ores of the Boundary district. A somewhat later major producer was the Premier mine at Stewart. In the 1930's the price of gold increased and the value of production soared, new discoveries were made and old mines were revived. The principal gold camps, in order of output of gold, have been Bridge River, Rossland, Portland Canal, Hedley, Wells, and Sheep Creek. In 1971 the Bralorne mine at Bridge River closed.

With the closing of the Bralorne mine, most of the lode gold is produced as a by-product of copper, copper-zinc-silver, and other base metal mining. Because of the volume of this production the amount of gold produced is still at a fairly high level, and with the significant rise in the price of gold in the 1970's the value of production has exceeded the peaks reached during the era of gold mines in the 1930's. With the new high prices for gold, interest has reawakened in vein and bulk gold properties with new producing mines like Carolin, Baker, Erickson and Morris Summit (Scottie Gold). *See* Tables 3-1, 3-3, 3-6, and 3-7B. *See* Table 3-12 for a complete list of current producers.

Gold, placer—The early explorations and settlement of the province followed rapidly on the discovery of gold-bearing placer creeks throughout the country. The first placer-miners came in 1858 to mine the lower Fraser River bars upstream from Yale.

The year of greatest placer-gold production was 1863, shortly after the discovery of the placer in the Cariboo. Another peak year in 1875 marked the discovery of placer on creeks in the Cassiar. A minor peak year was occasioned by the discovery of placer gold in the Granite Creek in the Tulameen in 1885. A high level of production ensued after 1899, when the Atlin placers reached their peak output. Other important placer-gold camps were established at Goldstream, Fort Steele, Rock Creek, Omineca River, and Quesnel River. The last important strike was made on Cedar Creek in 1921, and coarse gold was found on Squaw Creek in 1927 and on Wheaton Creek in 1932.

Mining in the old placer camps revived during the 1930s under the stimulus of an increase in the price of fine gold from $20.67 per ounce to $35 per ounce in United States funds. Since World War II, placer mining declined under conditions of steadily rising costs and a fixed price for gold but is showing signs of revival in response to a freely floating gold price since 1972. Since 1858, more than 163 966 618 grams valued $111.9 million has been recovered.

A substantial part of the production, including much of the gold recovered from the Fraser River upstream from Yale (in the present New Westminster, Kamloops, and Lillooet Mining Divisions) and much of the early Cariboo production, was mined before the original organization of the Department of Mines in 1874. Consequently, the amounts recorded are based on early estimates and cannot be accurately assigned to individual mining divisions.

The first year of production for major placer-producing mining divisions was: Atlin, 1898; Cariboo, 1859; Liard, 1873; Lillooet, 1858; Omineca, 1869.

In 1965, changes were made in the allocation of placer gold in New Westminster and Similkameen Mining Divisions and "not assigned," to reconcile those figures with data incorporated in Bulletin 28, *Placer Gold Production of British Columbia*. *See* Tables 3-1, 3-3, 3-6, and 3-7A.

Granules—Rock chips used for bird grits, exposed aggregate, roofing, stucco, dash, terrazzo, etc., have been produced in constantly increasing quantities since 1930. Plants operate in Burnaby and near Grand Forks, Sirdar, Vananda, and Armstrong. *See* Tables 3-1, 3-3, and 3-7D.

Gypsum and gypsite—Production of gypsum and gypsite has been recorded since 1911. Between 1925 and 1956, more than 907 000 tonnes were shipped from Falkland and some was quarried near Cranbrook and Windermere. Since 1956, nearly all production has come from Windermere. *See* Tables 3-1, 3-3, and 3-7D.

Hydromagnesite—Small shipments of hydromagnesite were made from Atlin between 1904 and 1916 and from Clinton in 1921. *See* Tables 3-1 and 3-7D.

Indium—Production of indium as a by-product of zinc refining at the Trail smelter began in 1942. Production figures have not been disclosed since 1958.

Iron—Iron ore was produced in small quantities as early as 1885, commonly under special circumstances or as test shipment. Steady production started in 1951 with shipments of magnetite concentrates to Japan from Vancouver and Texada Islands.

Most of the known iron-ore deposits are magnetite, and occur in the coastal area. On the average they are low in grade and need to be concentrated. Producing mines have operated on Texada Island, at Benson Lake and Zeballos on Vancouver Island, and at Tasu and Jedway on Morseby Island. At Texada Island copper was a by-product of iron mining, and in the Coast Copper mine at Benson Lake iron was a by-product of copper mining. The latest operation, and to date the largest, is that of Wesfrob Mines Limited at Tasu, begun at the end of 1967; copper is produced as a by-product.

From January 1961 to August 1972, calcined iron sulphide from the tailings of the Sullivan mine was used for making pig iron at Kimberley. This was the first manufacture of pig iron in British Columbia. The iron occurs as pyrrhotite and pyrite in the lead-zinc ore of the Sullivan mine. In the process of milling, the lead and zinc minerals are separated for shipment to the Trail smelter, and the iron sulphides are separated from the waste rock. Over the years a stockpile has been built containing a reserve of about 18 million tonnes of iron ore.

The sulphur was removed in making pig iron and was converted to sulphuric acid, which was used in making fertilizer. A plant built at Kimberley converted the pig iron to steel, and a fabricating plant was acquired in Vancouver. The iron smelter at Kimberley closed in August 1972. The entire production, credited to the Fort Steele Mining Division in Table 3-7C, is of calcine. *See* Tables 3-1, 3-3, 3-6, and 3-7C.

Iron oxide—Iron oxide, ochre, and bog iron were mined as early as 1918 from several occurrences, but mainly from limonite deposits north of Squamish. None has been produced since 1950. *See* Tables 3-1 and 3-7D.

Jade (nephrite)—Production of jade (nephrite) has been recorded only since 1959 despite there being several years of significant production prior to that date. The jade is recovered from bedrock occurrences on Mount Ogden and near Dease Lake and as alluvial boulders from the Fraser River; the Bridge River and its tributaries, Marshall, Hell, and Cadwallader Creeks; O'Ne-ell, Ogden, Kwanika, and Wheaton Creeks. *See* Tables 3-1, 3-3, and 3-7D.

Lead—Lead was the most valuable single commodity for many years, but it was surpassed in value of annual production by zinc in 1950, by copper in 1966, by molybdenum in 1969, and in total production by zinc in 1966. Lead and zinc usually occur together in nature although not necessarily in equal amounts in a single deposit. Zinc is the more abundant metal, but lead ore usually is more valuable than zinc ore because it contains more silver as a by-product. For a long time British Columbia produced almost all of Canada's lead, but now produces about 29 per cent of the total. All of the concentrated ore was smelted and the metal refined at Trail in 1981.

Almost all of British Columbia's lead comes from the southeastern part of the province. The Sullivan mine at Kimberley is now producing about 93.1 per cent of the province's lead and has produced about 85.9 per cent of the grand total. This is one of the largest mines in the world and supports the great metallurgical works at Trail. Other mines are at Pend-d'Oreille River, North Kootenay Lake, Slocan, southwestern British Columbia, and Vancouver Island. In northwestern British Columbia less important parts of the total output have come from Tulsequah, the Premier mine, and several small mines in the general region of Hazelton. *See* Table 3-12 for the current lead producers.

A small amount of high-grade lead ore is shipped directly to the smelter, but most of the ore is concentrated by flotation and the zinc content is separated from the lead. All output from the Sullivan goes to the Trail smelter. Lead was first produced in 1887, and the total production amounts to approximately 8.0 million tonnes.

In 1958, revisions were made in some yearly totals for lead to adjust them for recovery of lead from slag treated at the Trail smelter. *See* Tables 3-1, 3-3, 3-6, and 3-7B.

Limestone—Besides being used for flux and granules (where it is recorded separately), limestone is used in agriculture, cement manufacture, the pulp and paper industry, and for making lime. It has been produced since 1886. Quarries now operate near Prince George, at Kamloops, and on the north end of Texada Island. *See* Tables 3-1, 3-3, and 3-7E.

Magnesium—In 1941 and 1942, Cominco Ltd. produced magnesium from magnesite mined from a large deposit at Marysville. *See* Tables 3-1 and 3-7C.

Magnesium sulphate—Magnesium sulphate was recovered in minor amounts at various times between 1915 and 1942 from small alkali lakes near Basque, Clinton, and Osoyoos. *See* Tables 3-1 and 3-7D.

Manganese—From 1918 to 1920, manganese ore was shipped from a bog deposit near Kaslo and from Hill 60 near Cowichan Lake, and in 1956 a test shipment was made from Olalla. *See* Tables 3-1 and 3-7C.

Mercury—Mercury was first produced near Savona in 1895. Since then small amounts have been recovered from the same area and from the Bridge River district. The main production to date was between 1940 and 1944 from the Pinchi Lake and Takla mines near Fort St. James. In 1968 the Pinchi Lake mine reopened and continued in operation until 1975 when it closed because of market situations. *See* Tables 3-1 and 3-7C.

Mica—No sheet mica has been produced commercially in British Columbia. Between 1932 and 1961, small amounts of mica schist for grinding were mined near Albreda, Armstrong, Oliver, Prince Rupert, and Sicamous. *See* Tables 3-1 and 3-7D.

Molybdenum—Molybdenum ore in small amounts was produced from high-grade deposits between 1914 and 1918. Recently, mining of large low-grade molybdenum and copper-molybdenum deposits has increased production to the point that molybdenum now ranks second in importance in annual value of metals produced in British Columbia. The upswing began when the Bethlehem mine recovered by-product molybdenum from 1964 to 1966, commencing again in 1978. In 1965 the Endako and Boss Mountain mines, followed by the Coxey in 1966, and British Columbia Molybdenum mine in 1967, all began operations as straight molybdenum producers. The British Columbia Molybdenum mine closed in 1972 and re-commenced shipping in 1982 as the Kitsault mine. The Boss Mountain mine closed in 1971 and reopened late in 1973. The Coxey and British Columbia Molybdenum mines closed in 1971 and 1972 respectively. In 1970 the Brenda mine, a combined copper-molybdenum producer, started operating, and Island Copper in 1971, and Lornex in 1972, while Gibraltar ceased molybdenum production in 1975 but recommenced in 1977. In 1981 the Highmont mine began shipping molybdenum. *See* Tables 3-1, 3-3, 3-6, and 3-7C.

Natro-alunite—In 1912 and 1913, 363 tonnes of natro-alunite was mined from a small low-grade deposit at Kyuquot Sound. There has been no subsequent production. *See* Tables 3-1 and 3-7D.

Natural gas—Commercial production of natural gas began in 1954 to supply the community of Fort St. John. In 1957 the gas plant at Taylor and the pipeline to serve British Columbia and the northwestern United States was completed.

The production shown in Tables 3-1, 3-3, 3-7A, and 3-14, is the total amount sold of residential gas from processing plants plus dry and associated gas from the gas-gathering system; that is, the quantity delivered to the main transmission-line. The quantity is net after deducting gas used on leases, metering difference, and gas used or lost in the cleaning plant. The quantity is reported as millions of cubic metres at standard condition [99.2 kPa (kilopascals) pressure, 15°C temperature, up to and including the year 1960, and thereafter 101.3 kPa pressure, 15°C temperature].

Full details of gross well output, other production, delivery, and sales are printed in the *Annual Summary of Operations, Petroleum Resources Division*.

Nickel—One mine, the Pride of Emory near Hope, shipped nickel ore in 1936 and 1937 and began continuous production in 1958. From 1960 to 1974, bulk copper and nickel concentrates have been shipped to Japan and Alberta respectively for smelting. The mine closed in August 1974. *See* Tables 3-1, 3-3, and 3-7C.

Niobium—Niobium was produced from placer deposits on Vowell and Malloy Creeks in the Bugaboo area in 1956. A test shipment of 8 187 tonnes of gravel was shipped by St. Eugene Mining Corporation Limited to Quebec Metallurgical Industries. The placer contained a variety of minerals, including pyrochlore and uraninite. Recovery from the test shipment was as follows: 104.39 kilograms of niobium and 146.29 kilograms of uranium and thorium.

Palladium—Palladium was recovered in 1928, 1929, and 1930 as a by-product of the Trail refinery and is presumed to have originated in copper concentrates shipped to the smelter from the Copper Mountain mine. *See* Tables 3-1 and 3-7C.

Perlite—In 1953 a test shipment of 1 009 tonnes was made from a quarry on François Lake. There has been no further production. *See* Tables 3-1 and 3-7D.

Petroleum, crude—See Crude oil.

Phosphate Rock—Between 1927 and 1933, Cominco Ltd. produced 3 485 tonnes of phosphate rock for test purposes, but the grade proved to be too low for commercial use. More test shipments were made in 1964, but there has been no commercial production. *See* Tables 3-1 and 3-7D.

Platinum—Platinum has been produced intermittently from placer streams in small amounts since 1887, mostly from the Tulameen and Similkameen Rivers. Placer platinum also has been recovered from Pine, Thibert, McConnell, Rainbow, Tranquille, Rock, and Government Creeks; from Quesnel, Fraser, Cottonwood, Peace, and Coquihalla Rivers; and from beach placers on Graham Island. Some platinum recovered between 1928 and 1930 as a by-product at the Trail refinery is presumed to have originated in copper concentrates shipped to the smelter from the Copper Mountain mine. Small amounts were contained in the placer gold in 1979. *See* Tables 3-1, 3-3, and 3-7C.

Propane—Propane is recovered from gas-processing plants at Taylor and Boundary Lake, and at oil refineries. *See* Tables 3-1, 3-3, and 3-7A.

Rhenium—Rhenium occurs in significant quantities only with molybdenite associated with prophyry copper deposits. It was first produced in 1972 by the Island Copper mine and is extracted as rhenium oxide from fumes produced during roasting of the molybdenite concentrate.

Rock—Production of rubble, riprap, and crushed rock has been recorded since 1909. *See* Tables 3-1, 3-3, and 3-7E.

Sand and gravel—Sand and gravel is used as aggregate in concrete work. The output varies from year to year according to the level of activity in the construction industry. *See* Tables 3-1, 3-3, and 3-7E.

Selenium—The only recorded production of selenium, 332 kilograms, was in 1931 from the refining of blister copper from the Anyox smelter. *See* Tables 3-1 and 3-7C.

Silver—Silver is recovered from silver ores or as a by-product of other ores. Most of it is refined in Trail, and some is exported in concentrated ores of copper, lead, and zinc to American and Japanese smelters. Silver bullion was produced by the Torbit mine from 1949 to 1959.

Some silver is associated with galena, while other is recovered from gold and copper ores, and although the silver in such ores is usually no more than a fraction of an ounce per tonne, even that amount is important in a large tonnage operation.

Production of silver began in 1887 from silver-copper and silver-lead ores in the Kootenays and has continued in this area to the present. Now, most of the silver is a by-product of lead-zinc ores and nearly all is refined at Trail, although some is exported with concentrates to American and Japanese smelters. Today the greatest single source of silver is the Sullivan mine, which has been in production since 1900. By 1981 the Sullivan mine has accounted for 46 per cent of the total silver production of the province. A significant total amount is contributed by the Lynx, Lornex, Island Copper, Afton, Silmonac, and Granisle mines. Table 3-12 details the current silver production. The only steady producer that is strictly a silver mine is the Highland Bell mine at Beaverdell, in operation since 1922. A former important mine, the Premier near Stewart, produced more than 1.3 million kilograms of silver between 1918 and 1968. Most important new mine is the Sam Goosly mine of Equity Silver Mines Ltd. near Houston. *See* Tables 3-1, 3-3, 3-6, and 3-7B.

In 1981, silver totals include 54 505 grams, valued at $19,164, recovered and paid for in the placer gold.

Sodium carbonate—Sodium carbonate was recovered between 1921 and 1949 from alkali lakes in the Clinton area and around Kamloops. There has been no further production. *See* Tables 3-1 and 3-7D.

Stone (see Building-stone)—Cut stone for building purposes is prepared from rock produced at quarries in various parts of the province when required. Two of the most productive quarries have operated on Haddington and Nelson Islands. *See* Tables 3-1, 3-3, and 3-7E.

Structural materials—In Table 3-7E the value of $5 972 171 for unclassified materials is the total for structural materials in the period 1886–1919 that cannot be allotted to particular classes of structural materials or assigned to mining divisions, and includes $726 323 shown against 1896 in Table 3-2 that includes unclassified structural materials in that and previous years not assignable to particular years. The figure $3 180 828 in Table 3-7E under "Other Clay Products" is the value in the period 1886–1910 that cannot be allotted to particular clay products or assigned to mining divisions. *See* Tables 3-1, 3-2, 3-3, 3-7A, and 3-7E.

Sulphur—The production of sulphur has been recorded since 1916. From 1916 to 1927 the amounts include the sulphur content of pyrite shipped. From 1928 the amounts include the estimated sulphur content of pyrite shipped, plus the sulphur contained in sulphuric acid made from waste smelter gases. The sulphur content of pyrrhotite roasted at the Kimberley fertilizer plant is included since 1953. Elemental sulphur has been recovered from the Westcoast Transmission Co. Ltd. plant at Taylor since 1958 and the Fort Nelson plant of Petrosul International Ltd. since 1978. *See* Tables 3-1, 3-3, and 3-7D.

Talc—Between 1916 and 1936, talc was quarried at Leech River and at Anderson Lake to make dust for asphalt roofing. There has been no production since 1936. *See* Tables 3-1 and 3-7D.

Thorium—See Niobium.

Tin—Tin, as cassiterite, is a by-product of the Sullivan mine, where it has been produced since 1941. Tin is also produced in a lead-tin alloy at the Trail smelter. *See* Tables 3-1, 3-3, and 3-7C.

Tungsten—Tungsten, very largely as scheelite concentrates, was produced from 1937 to 1958, first from the Columbia Tungstens (Hardscrabble) mine in the Cariboo in 1937 and during World War II from the Red Rose mine near Hazelton and the Emerald mine near Salmo. The Red Rose closed in 1954 and the Emerald in 1958. Small amounts of scheelite have been produced from the Bridge River, Revelstoke, and other areas where demand was high. In 1970, production began from the Invincible mine near Salmo, which closed in 1973.

A very small amount of wolframite came from Boulder Creek near Atlin. *See* Tables 3-1, 3-3, and 3-7C.

Uranium—See Niobium.

Volcanic ash—The only recorded production of volcanic ash is 27 tonnes from the Cariboo Mining Division in 1954. *See* Table 3-7D.

Zinc—Zinc was first produced in 1905. For many years lead was the most valuable single metal, but in 1950 the annual value of production of zinc surpassed that of lead and in 1966 the total value of copper production exceeded that of zinc. In 1977 the production of zinc was exceeded by that of copper, molybdenum, asbestos, coal, crude oil, and natural gas. Zinc is invariably associated with lead, and most ores are mined for their combined values in zinc, lead, and silver, and rarely for their zinc content alone. Some zinc ores contain a valuable amount of gold, and zinc is associated with copper at Lynx mine. Modern practice is to concentrate and separate the zinc mineral (sphalerite) from the lead mineral (galena). Most of the zinc concentrates go to the zinc-recovery plant at Trail, are roasted, and are converted electronically to refined metal. Usually some concentrates are shipped to American or Japanese smelters.

About 84 per cent of the zinc that has been mined in British Columbia has originated in southeastern British Columbia, at the Sullivan mine, and at mines near Ainsworth, Invermere, Moyie Lake, Riondel, Salmo, Slocan, and Spillimacheen. Other production has come from mines at Portland Canal and Tulsequah and is coming from Buttle Lake and Callaghan Creek. The greatest zinc mine is the Sullivan, which contributed about 72 per cent of the total zinc production of the province. *See* Table 3-12 for details of current zinc producers.

Records for the period 1905 to 1908 show shipments totalling 17 096 tonnes of zinc ore and zinc concentrates of unstated zinc content. In 1918, revisions were made to some yearly totals for zinc to adjust them for recovery of zinc from slag treated at the Trail smelter. *See* Tables 3-1, 3-3, 3-6, and 3-7B.

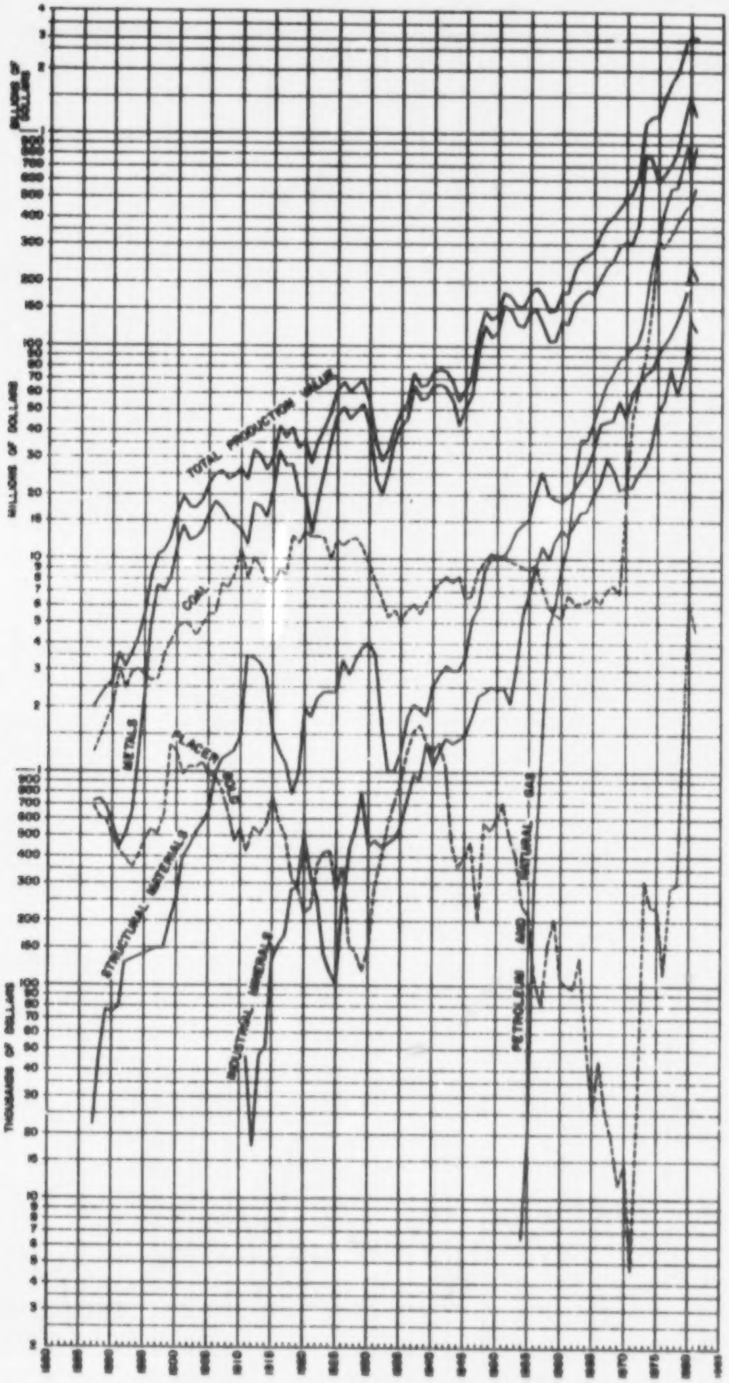

Figure 3-1—Value of mineral production, 1887–1981.

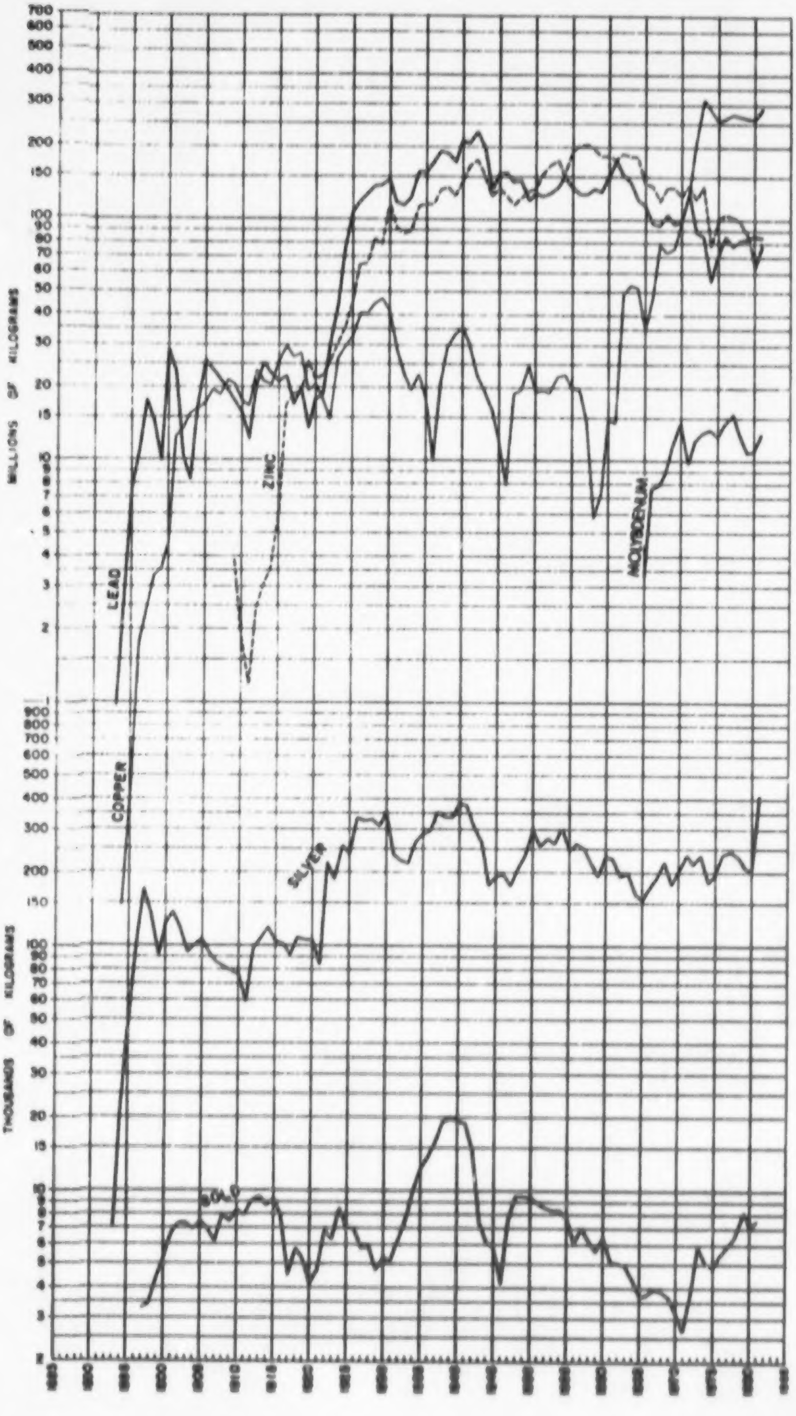

Figure 3-2—Production quantities of gold, silver, copper, lead, zinc, and molybdenum, 1893–1981.

Prices[1] Used in Valuing Production of Gold, Silver, Copper, Lead, Zinc, and Coal

Year	Gold, Fine	Silver, Fine	Copper	Lead	Zinc	Coal
	$/g	$/g	$/kg	$/kg	$/kg	$/t
1901	0.66457	0.01801 N.Y.	0.355 N.Y.	0.057 N.Y.		2.92
1902	"	.01593 "	.258 "	.081 "	....	2.90
1903	"	.01633 "	.292 "	.084 "	....	2.94
1904	"	.01716 "	.283 "	.086 "	....	2.89
1905	"	.01650 "	.344 "	.094 "	....	2.98
1906	"	.02040 "	.425 "	.106 "	....	2.88
1907	"	.01995 "	.441 "	.106 "	....	3.38
1908	"	.01615 "	.291 "	.083 "	....	3.43
1909	"	.01573 "	.286 "	.085 "	....	3.52
1910	"	.01634 "	.281 "	.088 "	....	3.69
1911	"	.01628 "	.273 "	.088 "	0.101 E. St. L.	3.51
1912	"	.01858 "	.360 "	.089 "	.108 "	3.70
1913	"	.01826 "	.337 "	.087 "	.130 "	3.74
1914	"	.01675 "	.300 "	.077 "	.106 "	3.69
1915	"	.01518 "	.381 "	.092 "	.097 "	3.78
1916	"	.02006 "	.600 "	.136 "	.248 "	3.80
1917	"	.02487 "	.399 "	.174 "	.240 "	3.84
1918	"	.02956 "	.543 "	.147 "	.167 "	5.50
1919	"	.03394 "	.412 "	.114 "	.153 "	5.42
1920	"	.03080 "	.385 "	.158 "	.138 "	5.20
1921	"	.01914 "	.276 "	.090 "	.144 "	5.30
1922	"	.02062 "	.295 "	.114 "	.087 "	5.20
1923	"	.01981 "	.318 "	.144 "	.107 "	5.30
1924	"	.02040 "	.287 "	.161 "	.124 "	5.39
1925	"	.02221 "	.310 "	.173 Lond.	.119 "	5.28
1926	"	.01997 "	.304 "	.149 "	.174 Lond.	5.34
1927	"	.01812 "	.285 "	.116 "	.163 "	5.30
1928	"	.01870 "	.321 "	.101 "	.137 "	5.19
1929	"	.01704 "	.399 "	.111 "	.121 "	5.22
1930	"	.01227 "	.286 "	.087 "	.119 "	5.21
1931	"	.00923 "	.179 "	.060 "	.079 "	4.80
1932	.75459	.01018 "	.141 Lond.	.047 "	.056 "	4.45
1933	.91953	.01216 "	.164 "	.053 "	.053 "	4.30
1934	1.10922	.01526 "	.164 "	.054 "	.071 "	4.41
1935	1.13140	.02083 "	.172 "	.069 "	.067 "	4.35
1936	1.12626	.01451 "	.209 "	.086 "	.068 "	4.66
1937	1.12497	.01443 "	.288 "	.113 "	.073 "	4.68
1938	1.13108	.01398 "	.220 "	.074 "	.108 "	4.42
1939	1.16195	.01302 "	.223 "	.070 "	.068 "	4.43
1940	1.23782	.01230 "	.222 "	.074 "	.068 "	4.70
1941	1.23782	.01230 "	.222 "	.074 "	.075 "	4.57
1942	1.23782	.01324 "	.222 "	.074 "	.075 "	4.55
1943	1.23782	.01455 "	.259 "	.083 "	.075 "	4.60
1944	1.23782	.01383 "	.265 "	.099 "	.088 "	4.68
1945	1.23782	.01511 "	.277 "	.110 "	.095 "	4.67
1946	1.18156	.02689 "	.282 "	.149 "	.142 "	5.16
1947	1.12529	.02315 "	.450 "	.301 "	.172 "	5.64
1948	1.12529	.02411 Mont.	.493 U.S.	.398 "	.248 "	6.71
1949	1.15744	.02387 U.S.	.440 "	.348 U.S.	.307 "	7.18
1950	1.22335	.02593 "	.517 "	.319 "	.292 U.S.	7.09
1951	1.18477	.03040 "	.611 "	.406 "	.332 "	7.12
1952	1.10182	.02674 "	.685 "	.355 "	.439 "	7.65
1953	1.10665	.02693 "	.669 "	.292 "	.350 "	7.58
1954	1.09539	.02668 "	.642 "	.302 "	.235 "	7.72
1955	1.10986	.02825 "	.844 "	.329 "	.230 "	7.43
1956	1.10729	.02873 "	.877 "	.347 "	.267 "	7.26
1957	1.07867	.02799 "	.574 "	.310 "	.293 "	7.45
1958	1.09250	.02779 "	.516 "	.259 "	.246 "	8.21
1959	1.07932	.02812 "	.611 "	.257 "	.221 "	8.74
1960	1.09153	.02850 "	.639 "	.256 "	.242 "	7.32
1961	1.14008	.03012 "	.620 "	.243 "	.277 "	8.16
1962	1.20278	.03730 "	.672 "	.227 "	.258 "	8.19
1963	1.21371	.04436 "	.676 "	.265 "	.274 "	8.08
1964	1.21371	.04484 "	.737 "	.323 "	.290 "	7.65
1965	1.21307	.04481 "	.846 "	.380 "	.323 "	7.75
1966	1.21242	.04479 "	1.176 "	.359 "	.345 "	8.02
1967	1.21403	.05373 "	1.125 "	.333 "	.344 "	8.54
1968	1.21242	.07429 "	1.195 "	.321 "	.329 "	8.72
1969	1.21178	.06196 "	1.470 "	.354 "	.312 "	8.82

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[1] *See* page 59 for detailed explanation.

Prices[1] Used in Valuing Production of Gold, Silver, Copper, Lead, Zinc, and Coal—Continued

Year	Gold, Fine	Silver, Fine	Copper	Lead	Zinc	Coal
	$/g	$/g	$/kg	$/kg	$/kg	$/t
1970	1.17345	.05946 U.S.	1.294[2]	.360 U.S.	.353 U.S.	8.16
1971	1.13622	.05014 "	1.030[2]	.308 "	.359 "	11.06
1972	1.84934	.05348 "	.989[2]	.328 "	.388 "	12.08
1973	3.13185	.08251 "	1.835[2]	.359 "	.455 "	12.71
1974	5.34868[2]	.15653[2]	1.884[2]	.422[2]	.767[2]	19.93
1975	5.20466[2]	.15560[2]	1.283[2]	.346[2]	.808[2]	35.53
1976	4.03514[2]	.13571[2]	1.438[2]	.384[2]	.615[2]	39.63
1977	5.29972[2]	.15707[2]	1.398[2]	.541[2]	.591[2]	39.04
1978	7.32948[2]	.19832[2]	1.577[2]	.637[2]	.544[2]	40.35
1979	12.58090[2]	.44228[2]	2.412[2]	1.043[2]	.700[2]	41.56
1980	22.77657[2]	.76814[2]	2.534[2]	.862[2]	.732[2]	42.64
1981	*17.53536*[2]	*.37751*[2]	*2.10723*[2]	*.725*[2]	*.846*[2]	*47.16*

[1] *See* page 59 for detailed explanation.

[2] *See* page 60 for explanation.

Table 3-1—Mineral Production: Total to Date, Past Year, and Latest Year

Products[1]		Total Quantity to Date[2]	Total Value to Date	Quantity, 1980	Value, 1980	Quantity, 1981	Value, 1981
Metals			$		$		$
Antimony	kg	27 463 737	29 017 223	78 654	416 080	68 323	360 745
Bismuth	kg	3 365 861	16 412 299	23 501	136 306	47 300	102 641
Cadmium	kg	20 916 003	89 339 487	92 360	560 679	101 962	371 077
Chromite	t	722	32 295				
Cobalt	kg	114 484	376 661				
Copper	kg	4 774 374 495	6 042 372 867	264 674 830	670 623 616	290 088 241	611 282 050
Gold—							
placer	g	163 966 618	111 868 461	280 104	6 213 376	291 705	4 540 289
lode, fine	g	592 201 638	1 081 760 590	7 197 312	163 930 073	7 468 769	131 542 422
Iron concentrates	t	35 027 355	384 159 662	653 324	13 670 233	602 272	14 274 498
Lead	kg	8 081 948 334	1 832 288 812	76 709 447	66 096 223	84 854 093	61 529 276
Magnesium	kg	92 419	88 184				
Manganese	t	1 564	32 668				
Mercury	kg	6 094 387	49 218 263				
Molybdenum	kg	195 058 284	1 680 745 587	11 179 501	288 934 398	12 933 224	198 240 391
Nickel	kg	23 337 783	51 698 754				
Palladium	g	23 296	30 462				
Platinum	g	44 042	138 801				
Selenium	kg	332	1 389				
Silver	g	17 692 360 655	974 409 883	203 801 811	156 548 306	403 754 797	152 420 716
Tin	kg	9 949 444	33 799 570	139 517	2 438 881	150 341	2 198 138
Tungsten (WO_3)	kg	9 090 002	48 068 016				
Zinc	kg	7 657 312 267	2 046 653 463	67 481 328	49 363 417	79 214 552	67 026 535
Others			41 461 505		10 070 592		2 793 757
Totals			14 513 974 902		1 429 002 180		1 246 682 535
Industrial Minerals							
Arsenious oxide	kg	9 987 789	273 201				
Asbestos	t	1 794 403	685 956 188	100 089	81 688 936	90 914	76 770 285
Bentonite	t	718	16 838				
Fluxes	t	4 029 554	9 138 286	20 573	93 135	48 313	909 678
Granules	t	687 324	18 869 740	31 393	1 694 947	28 297	1 756 810
Gypsum and gypsite	t	9 674 116	45 599 414	751 067	5 387 949	684 924	5 808 770
Hydromagnesite	t	2 044	27 536				
Iron oxide and ochre	t	16 427	155 030				
Jade	kg	2 647 122	8 524 951	449 156	1 580 241	59 208	133 598
Magnesium sulphate	t	12 604	254 352				
Mica	kg	5 815 954	185 818				
Natro-alunite	t	474	9 398				
Perlite	t	1 009	11 120				
Phosphate rock	t	3 485	16 894				
Sodium carbonate	t	9 518	118 983				
Sulphur	t	9 942 966	191 464 211	359 413	21 712 359	907 566	33 337 562
Talc	t	1638	34 871				
Others			19 925 597		3 768 440		4 152 139
Totals			980 582 468		115 926 007		122 464 842
Structural Materials							
Cement	t	22 694 986	735 156 343	1 351 320	90 881 086	965 922	82 372 375
Clay products			158 348 087		10 387 121		10 292 772
Lime and limestone	t		118 476 562	3 129 762	9 945 044	2 659 406	9 400 205
Rubble, rip-rap, crushed rock	t		147 442 187	7 019 167	32 436 456	3 168 694	11 100 383
Sand and gravel	t		848 131 526	45 278 202	98 666 100	42 361 930	87 603 864
Building stone	t		9 397 280	91	9 850	383	16 680
Not assigned			5 972 171				
Totals			2 022 924 156		242 325 657		200 786 279
Coal							
Coal—sold and used	t	223 409 580	3 772 267 287	10 823 530	461 492 857	11 752 621	554 271 292
Petroleum and Natural Gas							
Crude oil	m^3	54 514 799	1 735 210 764	2 002 128	189 561 479	2 035 953	236 170 548
Field condensate	m^3	315 957	16 652 082	36 855	3 489 431	27 87[illegible]	[illegible] 233 036
Plant condensate	m^3	3 546 858	79 500 624	133 601	11 641 991	124 9[illegible]	[illegible] 284 259
Natural gas to pipeline	10^3m^3	154 065 227	3 678 466 044	8 931 833	612 545 107	8 062 [illegible]	[illegible] 795 096
Butane	m^3	1 832 533	44 275 292	89 556	6 491 914	84 [illegible]	[illegible] 953 076
Propane	m^3	1 447 857	30 855 393	75 507	4 572 704	64 [illegible]	[illegible] 080 069
Totals			5 584 960 199		828 302 626		884 516 084
Grand Totals			26 874 709 012		3 077 049 327		3 008 721 032

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[1] *See* notes on individual products listed alphabetically on pages 62 to 71.

[2] *See* page 10 for conversion table to old system.

Table 3-2—Total Value of Mineral Production, 1836–81

Year	Metals	Industrial Minerals	Structural Materials	Coal	Petroleum and Natural Gas	Total
	$	$	$	$	$	$
1836–86	52 880 750	...	43 650	10 758 565	...	63 610 965
1887	729 381	...	22 168	1 240 080	...	1 991 629
1888	745 794	...	46 432	1 467 903	...	2 260 129
1889	685 512	...	77 517	1 739 490	...	2 502 519
1890	572 884	...	75 201	2 034 420	...	2 682 505
1891	447 136	...	79 475	3 087 291	...	3 613 902
1892	511 075	...	129 234	2 479 005	...	3 119 314
1893	659 969	...	...	2 934 882	...	3 594 851
1894	1 191 728	...	...	3 038 859	...	4 230 587
1895	2 834 629	...	...	2 824 687	...	5 659 316
1896	4 973 769	...	726 323	2 693 961	...	8 394 053
1897	7 575 262	...	150 000	2 734 522	...	10 459 784
1898	7 176 870	...	150 000	3 582 595	...	10 909 465
1899	8 107 509	...	200 000	4 126 830	...	12 434 312
1900	11 360 546	...	250 000	4 744 530	...	16 355 076
1901	14 258 455		400 000	5 016 398		19 674 853
1902	12 163 561		450 000	4 832 257		17 445 818
1903	12 640 083	...	525 000	4 332 297		17 497 380
1904	13 424 755	2 400	575 000	4 953 024		18 955 179
1905	16 289 165		660 800	5 511 861		22 461 826
1906	18 449 602		982 900	5 548 044		24 980 546
1907	17 101 305		1 149 400	7 637 713		25 888 418
1908	15 277 991		1 200 000	7 356 866		23 784 857
1909	14 668 141		1 270 559	8 574 884		24 513 584
1910	13 768 731		1 500 000	11 108 335		26 377 066
1911	11 880 062	46 345	3 500 917	8 071 747		23 499 071
1912	18 218 266	17 500	3 436 222	10 786 812		32 458 800
1913	17 701 432	46 446	3 249 605	9 107 460		30 194 943
1914	15 790 727	51 810	2 794 107	7 745 847		26 382 491
1915	20 765 212	133 114	1 509 235	7 114 178		29 521 739
1916	32 092 648	150 718	1 247 912	8 900 675		42 391 953
1917	27 299 934	174 107	1 097 900	8 484 343		37 056 284
1918	27 957 302	281 131	783 280	12 833 994		41 855 707
1919	20 058 217	289 426	980 790	11 975 671		33 304 104
1920	19 687 532	508 601	1 962 824	13 450 169		35 609 126
1921	13 160 417	330 503	1 808 392	12 836 013		28 135 325
1922	19 605 401	251 922	2 469 967	12 880 060		35 207 350
1923	25 769 215	140 409	2 742 388	12 678 548		41 330 560
1924	35 959 566	116 932	2 764 013	9 911 935		48 752 446
1925	46 480 742	101 319	2 766 838	12 168 905		61 517 804
1926	51 867 792	223 748	3 335 885	11 650 180		67 077 605
1927	45 134 289	437 729	2 879 160	12 269 135		60 720 313
1928	48 640 158	544 192	3 409 142	12 633 510		65 227 002
1929	52 805 345	807 502	3 820 732	11 256 260		68 689 839
1930	41 785 380	457 225	4 085 105	9 435 650		55 763 360
1931	23 530 469	480 319	3 538 519	7 684 155		35 233 462
1932	20 129 869	447 495	1 705 708	6 523 644		28 806 716
1933	25 777 723	460 683	1 025 586	5 375 171		32 639 163
1934	35 177 224	486 554	1 018 719	5 725 133		42 407 630
1935	42 006 618	543 583	1 238 718	5 048 864		48 837 783
1936	45 889 944	724 362	1 796 677	5 722 502		54 133 485
1937	65 224 245	976 171	2 098 339	6 139 920		74 438 675
1938	55 959 713	916 841	1 974 976	5 565 069		64 416 599
1939	56 216 049	1 381 720	1 832 464	6 280 956		65 711 189
1940	64 332 166	1 073 023	2 534 840	7 088 265		75 028 294
1941	68 807 630	1 253 561	2 845 262	7 660 000		77 566 453
1942	63 626 140	1 434 382	3 173 635	8 237 172		76 471 329
1943	55 005 394	1 378 337	3 025 255	7 742 030		67 151 016
1944	42 095 013	1 419 248	3 010 088	8 217 966		54 742 315
1945	50 673 592	1 497 720	3 401 229	6 454 360		62 026 901
1946	58 834 747	1 783 010	5 199 563	6 732 470		72 549 790
1947	95 729 867	2 275 972	5 896 803	8 680 440	...	112 583 082
1948	124 091 753	2 358 877	8 968 222	9 765 395	...	145 184 247
1949	110 219 917	2 500 799	9 955 790	10 549 924	...	133 226 430
1950	117 166 836	2 462 340	10 246 939	10 119 303	...	139 995 418

Table 3-2—Total Value of Mineral Production, 1836–1981—Continued

Year	Metals	Industrial Minerals	Structural Materials	Coal	Petroleum and Natural Gas	Total
	$	$	$	$	$	$
1951	153 598 411	2 493 840	10 606 048	10 169 617	....	176 867 916
1952	147 857 523	2 181 464	11 596 961	9 729 739	....	171 365 687
1953	126 755 705	3 002 673	13 555 038	9 528 279	....	152 841 695
1954	123 834 286	5 504 114	14 395 174	9 154 544	6 545	152 894 663
1955	142 609 505	6 939 490	15 299 254	8 986 501	18 610	173 853 360
1956	149 441 246	9 172 792	20 883 631	9 346 518	319 465	189 163 652
1957	125 353 920	11 474 050	25 626 939	7 340 339	1 197 581	170 992 829
1958	104 251 112	9 958 768	19 999 576	5 937 860	4 806 233	144 953 549
1959	105 076 530	12 110 286	19 025 209	5 472 064	5 967 128	147 651 217
1960	130 304 373	13 762 102	18 829 989	5 242 223	9 226 646	177 365 333
1961	128 565 774	12 948 308	19 878 921	6 802 134	11 612 184	179 807 321
1962	159 627 293	14 304 214	21 366 265	6 133 986	27 939 726	229 371 484
1963	172 852 866	16 510 898	23 882 190	6 237 997	36 379 636	255 863 587
1964	180 926 329	16 989 469	26 428 939	6 327 678	36 466 753	267 139 168
1965	177 101 733	20 409 649	32 325 714	6 713 590	44 101 662	280 652 348
1966	208 664 003	22 865 324	43 780 272	6 196 219	54 274 187	335 780 005
1967	235 865 318	29 364 065	44 011 488	7 045 341	67 096 286	383 382 498
1968	250 912 026	26 056 782	45 189 476	7 588 989	75 281 215	405 028 488
1969	294 881 114	20 492 943	55 441 528	6 817 155	86 756 009	464 388 749
1970	309 981 470	22 020 359	46 104 071	19 559 669	90 974 467	488 640 036
1971	301 059 951	21 909 767	59 940 333	45 801 936	99 251 158	527 963 145
1972	372 032 770	25 764 120	66 745 698	66 030 210	105 644 978	636 217 776
1973	795 617 596	27 969 664	73 720 831	87 976 105	124 104 445	1 109 388 641
1974	764 599 451	33 676 214	78 088 393	154 593 643	233 275 505	1 264 233 206
1975	586 650 344	48 667 602	90 928 011	317 111 744	320 719 474	1 364 077 175
1976	646 750 403	52 917 142	100 938 648	298 683 679	420 973 564	1 520 263 436
1977	714 036 707	79 185 099	115 650 992	328 846 883	550 439 856	1 788 159 537
1978	819 778 518	59 471 361	142 105 285	381 895 241	568 931 051	1 972 181 456
1979	1 350 776 761	83 100 984	187 671 941	439 280 152	896 377 125	2 957 206 963
1980	1 429 002 180	115 926 007	242 325 657	461 492 857	828 302 626	3 077 049 327
1981	1 246 682 535	122 464 842	200 786 279	554 271 292	884 516 084	3 008 721 032
Totals	14 513 974 902	980 582 468	2 022 924 156	3 772 267 287	5 584 960 199	26 874 709 012

Table 3-3—Mineral Production for the 10 Years, 1972–1981

Description	1972		1973		1974		1975		1976	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Metals		$		$		$		$		$
Antimony kg	308 260	419 042	753 110	1 192 118	221 238	879 897	364 045	1 467 928	447 001	1 636 871
Bismuth kg	42 556	324 617	1 293	13 058	33 711	680 771	19 163	261 931	20 261	226 462
Cadmium kg	315 540	1 759 995	367 761	2 951 236	195 979	1 532 096	320 923	1 971 035	356 422	1 530 800
Cobalt kg	70 642	155 739	18 555	117 403						
Copper kg	211 832 288	209 403 822	317 603 055	582 803 251	287 547 048	541 644 913	258 497 599	331 693 850	263 618 197	378 984 941
Gold—placer g	21 492	26 905	119 156	311 524	45 162	232 512	43 744	232 204	26 064	115 613
lode, fine g	3 782 871	6 995 448	5 784 723	18 117 268	5 001 082	26 749 083	4 819 241	25 082 494	5 393 477	21 761 502
Iron concentrates t	1 139 698	11 642 379	1 420 160	12 906 063	1 306 930	12 742 227	1 305 840	15 273 878	1 255 277	14 760 526
Lead kg	88 109 663	28 896 566	84 890 924	30 477 936	55 252 692	23 333 016	70 603 483	24 450 158	85 407 582	32 796 533
Molybdenum kg	12 719 391	43 260 349	13 785 264	51 851 509	13 789 825	60 791 552	13 026 627	71 201 391	14 088 686	94 109 138
Nickel kg	1 469 851	4 601 486	1 119 221	3 775 232	688 656	2 351 406				
Silver g	215 420 498	11 519 660	236 987 318	19 552 997	181 695 950	28 440 365	196 305 885	30 545 947	239 720 882	32 532 836
Tin kg	159 230	473 908	138 221	597 265	143 816	1 150 722	32 511	200 669	102 262	712 912
Tungsten (WO_3) kg	577 509	2 167 663	640 378	4 224 062						
Zinc kg	121 719 968	47 172 894	137 380 768	62 564 751	77 733 732	59 582 753	99 668 230	80 572 872	106 498 987	65 499 108
Others		3 212 297		4 161 923		4 488 138		3 695 987		2 083 161
Subtotals		372 032 770		795 617 596		764 599 451		586 650 344		646 750 403
Industrial Minerals										
Asbestos t	95 986	20 870 241	98 852	21 102 892	83 403	27 398 900	76 771	37 849 743	90 443	40 727 296
Diatomite t	1 338	52 073	513	9 526	1 593	32 600	5 847	229 483	2 737	182 159
Fluxes (quartz, limestone) t	28 667	59 246	41 937	106 371	34 451	206 049	35 914	174 824	11 378	33 263
Granules (quartz, limestone, granite) t	33 709	757 924	31 135	857 643	31 546	1 025 615	33 316	1 144 968	31 476	1 219 884
Gypsum and gypsite t	352 272	1 087 196	331 347	1 114 009	400 338	1 412 157	474 387	1 751 799	556 134	4 434 471
Jade kg	110 551	235 218	69 967	306 808	3 510	18 613	110 437	414 123	483 796	1 535 030
Sulphur t	270 074	2 306 933	286 701	4 187 387	206 646	3 068 507	246 079	5 738 134	231 704	4 296 189
Others		395 289		285 028		513 773		1 364 528		488 850
Subtotals		25 764 120		27 969 664		33 676 214		48 667 602		52 917 142
Structural Materials										
Cement t	808 230	21 014 112	862 521	24 935 624	890 372	25 828 823	915 293	31 681 722	846 548	34 973 746
Clay products		5 263 749		5 590 290		6 615 128		6 593 189		6 955 917
Lime and limestone t	1 838 227	3 357 927	1 954 008	3 633 870	2 097 909	4 297 547	1 976 415	4 349 800	2 173 831	5 610 063
Rubble, riprap, and crushed rock t	3 013 438	4 032 548	2 579 122	4 160 009	2 691 473	5 715 219	4 103 452	8 723 448	2 485 215	5 205 973
Sand and gravel t	31 593 921	33 076 196	30 811 402	35 379 590	31 440 908	35 611 346	28 945 523	39 575 457	36 073 618	48 138 635
Building-stone t	176	1 166	729	21 448	452	20 330	53	4 395	657	14 314
Subtotals		66 745 698		73 720 831		78 088 393		90 928 011		100 938 648
Coal										
Sold and used t	5 466 846	66 030 210	6 924 733	87 976 105	7 757 440	154 593 643	8 924 816	317 111 744	7 537 695	298 683 679
Total solid minerals		530 572 798		985 284 196		1 030 957 701		1 043 357 701		1 099 289 872
Petroleum and Natural Gas										
Crude oil m^3	3 788 849	63 166 717	3 368 902	68 306 032	3 012 501	103 335 328	2 269 898	94 229 725	2 367 450	116 595 050
Field condensate m^3	16 619	277 069	20 114	407 807	16 561	568 075	16 094	668 092	18 309	901 711
Plant condensate m^3	161 854	327 820	180 088	222 463	178 534	924 549	185 272	6 525 837	167 576	7 198 957
Natural gas delivered to pipeline 10^3m^3	9 939 498	41 616 824	10 789 269	54 762 105	9 016 996	128 018 726	9 236 489	214 733 528	8 799 508	287 997 059
Butane m^3	54 200	106 533	109 057	212 640	105 426	232 085	106 427	2 577 205	109 781	4 591 832
Propane m^3	76 323	150 015	99 188	193 398	89 373	196 742	81 975	1 985 087	88 195	3 688 955
Total petroleum and natural gas		105 644 978		124 104 445		233 275 505		320 719 474		420 973 564
Grand totals		636 217 776		1 109 388 641		1 264 233 206		1 364 077 175		1 520 263 436

Table 3-3—Mineral Production for the 10 Years, 1972–1981—Continued

Description	1977		1978		1979		1980		1981	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Metals		$		$		$		$		$
Antimony ... kg	596 207	2 519 739	459 521	2 083 895	177 046	916 081	78 654	416 080	68 323	360 745
Bismuth ... kg	18 540	187 612	28 172	166 452	33 809	173 667	23 501	136 306	47 300	102 641
Cadmium ... kg	320 711	1 720 051	253 803	1 186 320	239 096	1 417 506	92 360	560 679	101 962	371 077
Cobalt ... kg	...	...	...	...	...	...	...	...	...	...
Copper ... kg	275 224 115	384 736 661	273 692 676	431 694 395	272 163 001	656 359 923	264 674 830	670 623 616	290 088 241	611 282 050
Gold—placer ... g	46 170	289 075	36 515	295 001	214 106	2 649 918	280 104	6 213 376	291 705	4 540 289
lode, fine ... g	5 906 336	31 301 931	6 542 332	47 951 880	8 062 810	101 481 156	7 197 312	163 930 073	7 468 769	131 542 422
Iron concentrates ... t	445 317	7 362 345	615 569	11 597 462	668 026	13 008 475	653 324	13 670 233	602 272	14 274 498
Lead ... kg	78 172 646	42 316 293	81 064 539	51 640 564	84 451 905	88 100 363	76 709 447	66 096 223	84 854 093	61 529 276
Molybdenum ... kg	15 521 970	142 057 947	13 055 203	167 714 272	10 766 497	321 228 104	11 209 501	288 934 398	12 933 244	198 240 391
Platinum ... g	...	...	...	...	280	3 793	...	...	...	...
Silver ... g	241 503 007	37 934 098	227 271 890	45 071 509	214 117 518	94 700 656	203 801 811	156 548 306	403 754 797	152 420 716
Tin ... kg	187 478	1 912 300	261 863	3 675 508	240 984	3 818 948	139 517	2 438 881	150 341	2 198 138
Tungsten (WO$_3$) ... kg	...	...	...	...	...	...	...	...	...	...
Zinc ... kg	103 780 228	61 301 001	95 618 111	52 048 701	88 418 642	61 890 891	67 481 328	49 363 417	79 214 552	67 026 535
Others ...	...	397 654	...	4 652 559	...	5 027 280	...	10 070 592	...	2 793 757
Subtotals ...	...	714 036 707	...	819 778 518	...	1 350 776 761	...	1 429 002 180	...	1 246 682 535
Industrial Minerals										
Asbestos ... t	97 033	69 729 205	68 266	47 066 170	94 286	65 520 069	100 089	81 688 936	90 914	76 770 285
Diatomite ... t	1 239	49 595	2 184	59 346	1 452	33 025	3 615	138 273	3 600	155 232
Fluxes (quartz, limestone) ... t	28 624	95 461	22 475	56 894	27 741	129 035	43 986	93 135	48 313	509 678
Granules (quartz, limestone, granite) ... t	29 551	1 238 485	26 849	1 186 160	30 074	1 458 987	31 393	1 694 947	28 297	1 756 810
Gypsum and gypsite ... t	653 126	2 357 488	733 080	3 110 695	718 557	3 782 628	751 067	5 387 949	684 924	5 804 770
Jade ... kg	266 621	825 523	488 759	1 422 018	258 505	1 325 777	449 156	1 580 241	59 208	133 598
Sulphur ... t	248 892	3 871 660	322 181	5 647 993	383 724	9 616 390	359 413	21 712 359	507 566	33 337 562
Others ...	...	1 017 682	...	922 085	...	1 235 073	...	3 630 167	...	8 996 307
Subtotals ...	...	79 185 099	...	59 471 361	...	83 100 984	...	115 926 007	...	122 464 842
Structural Materials										
Cement ... t	909 522	42 705 320	1 020 065	56 140 564	1 550 596	89 185 273	1 351 320	90 881 086	955 922	82 372 375
Clay products ...	...	4 909 799	...	6 282 560	...	11 744 194	...	10 387 121	...	10 292 772
Lime and limestone ... t	2 231 166	5 861 614	2 512 867	6 929 484	2 880 138	8 037 476	3 129 762	9 945 044	2 659 406	9 400 205
Rubble, riprap, and crushed rock ... t	2 464 503	7 309 536	2 841 920	8 410 065	2 488 389	6 766 665	7 019 167	32 436 456	3 168 694	11 100 383
Sand and gravel ... t	53 994 528	54 809 121	38 353 326	64 324 582	46 241 983	71 918 633	45 278 202	98 666 100	42 361 930	87 603 864
Building-stone ... t	4 535	55 602	405	18 030	2 194	19 700	91	9 850	383	16 680
Subtotals ...	...	115 650 992	...	142 105 285	...	187 671 941	...	242 325 657	...	200 786 279
Coal										
Sold and used ... t	8 424 181	328 846 883	9 463 920	381 895 241	10 570 370	439 280 152	10 823 530	461 492 857	11 752 621	554 271 292
Total solid minerals ...	...	1 237 719 681	...	1 403 250 405	...	2 060 829 838	...	2 248 746 701	...	2 124 204 948
Petroleum and Natural Gas										
Crude oil ... m^3	2 200 303	132 859 085	2 004 699	145 005 524	2 139 963	168 928 671	2 002 128	189 561 479	2 035 953	236 170 548
Field condensate ... m^3	24 465	1 477 248	25 386	1 836 217	32 549	2 569 418	36 885	3 489 431	27 871	3 233 036
Plant condensate ... m^3	180 267	9 751 058	155 503	10 269 861	184 398	13 396 500	133 601	11 641 991	124 946	13 284 259
Natural gas delivered to pipeline ... 10^{3}m^3	8 895 663	396 601 354	8 003 029	401 373 236	11 392 641	699 508 127	8 931 833	612 545 107	8 062 681	616 795 096
Butane ... m^3	111 357	5 358 167	106 580	5 932 766	112 683	7 122 711	89 556	6 491 914	84 635	9 953 076
Propane ... m^3	91 297	4 392 944	85 732	4 513 447	84 864	4 851 698	75 507	4 572 704	64 118	5 080 069
Total petroleum and natural gas ...	...	550 439 856	...	568 931 051	...	896 377 125	...	828 302 626	...	884 516 084
Grand totals ...	...	1 788 159 537	...	1 972 181 456	...	2 957 206 963	...	3 077 049 327	...	3 008 721 032

Table 3-4—Comparison of Total Quality and Value of Production, and Quantity and Value of Production Paid for to Mines

Metals		1981 Total Production		1981 Production Paid for to Mines	
	Units	Quantity	Value	Quantity	Value
			$		$
Antimony	kg	68 323	360 745		....
Bismuth	kg	47 300	102 641	....	....
Cadmium	kg	101 962	371 077	14 538	21 113
Copper	kg	290 088 241	611 282 050	289 691 147	435 570 154
Gold—placer	g	291 705	4 540 289	291 705	4 540 289
Gold—lode, fine	g	7 468 769	131 542 422	7 468 769	105 470 072
Iron concentrates	t	602 272	14 274 498	602 272	14 274 498
Lead	kg	84 854 093	61 529 276	83 238 157	47 823 012
Molybdenum	kg	12 933 224	198 240 391	12 933 224	198 240 391
Silver	g	403 754 797	152 420 716	390 374 839	106 851 141
Tin	kg	150 341	2 198 138	124 213	1 743 415
Zinc	kg	79 214 552	67 026 535	67 621 175	44 603 738
Others		....	2 793 757	....	941 966
Totals		....	1 246 682 535	....	960 079 789

NOTE: For metals, the total quantity and value of production include the quantities paid for to the mines, and the smelter and refining production that can be attributed to the mines but is not paid for. The quantity and value paid for to the mines, excluding outward transportation costs, smelting and refining costs, penalties and deductions, are shown separately for comparative purposes.

Table 3-5—Exploration and Development Expenditures, 1974—1981

	Physical Work and Surveys	Administration, Overhead, Land Costs, Etc.	Construction, Machinery and Equipment, Other Capital Costs	Totals
A. Exploration on Undeclared Mines	$	$	$	$
Metal mines—				
1974	18 773 326	6 525 878	128 144	25 427 348
1975	16 366 152	5 298 367	442 327	22 106 846
1976	20 437 180	6 365 331	381 416	27 183 927
1977	19 097 099	6 974 231	106 059	26 177 389
1978	22 724 774	5 715 214	1 035 353	29 475 341
1979	42 789 552	10 438 163	583 114	53 810 829
1980	74 378 109	14 367 266	4 107 339	92 852 714
1981	88 908 669	19 060 910	10 976 496	118 946 075
Coal mines—				
1974	3 450 746	884 849	18 958	4 354 553
1975	9 955 507	3 057 843	....	13 013 350
1976	9 234 269	3 678 893	....	12 913 162
1977	14 741 425	4 797 788	....	19 539 213
1978	15 289 351	4 511 572	....	19 800 923
1979	11 765 168	6 073 861	....	17 839 029
1980	9 830 425	5 703 387	....	15 533 812
1981	25 557 948	9 866 432	1 932	35 426 312
Others—				
1974	42 706	11 134	....	53 840
1975	90 025	35 679	....	125 704
1976	73 453	47 760	....	121 213
1977	327 113	9 860	222 092	559 065
1978	342 100	117 180	....	459 280
1979	135 062	149 131	....	284 193
1980	1 340 398	189 292	....	1 529 690
1981	808 742	30 870	367 106	1 206 718
Totals—				
1974	22 266 778	7 421 861	147 102	29 835 741
1975	26 411 684	8 391 889	442 327	35 245 900
1976	29 744 902	10 091 984	381 416	40 218 302
1977	34 165 637	11 781 879	328 151	46 275 667
1978	38 356 225	10 343 966	1 035 353	49 735 544
1979	54 689 782	16 661 155	583 114	71 934 051
1980	85 548 932	20 259 945	4 107 339	109 916 216
1981	115 275 359	28 958 212	11 345 534	155 579 105
B. Exploration on Declared or Operating Mines				
Metal mines—				
1974	2 652 243	762 224	278 500	3 692 967
1975	2 792 378	3 090 135	....	5 882 513
1976	8 359 413	83 304	....	8 442 717
1977	2 988 366	2 020 259	....	5 008 625
1978	6 562 912	1 729 402	....	8 292 314
1979	6 946 143	1 585 176	263 586	8 794 905
1980	26 712 536	4 345 682	2 551 716	33 609 934
1981	7 559 289	466 704	8 000	8 033 993
Coal mines—				
1974	488 308	104 259	....	592 567
1975	1 000 000	....	....	1 000 000
1976	665 000	28 000	....	693 000
1977	5 978 043	25 115 000	....	31 093 043
1978	4 052 774	510 612	....	4 563 386
1979	3 376 551	398 984	....	3 775 535
1980	12 504 905	8 510 426	....	21 015 331
1981	6 008 376	348 780	....	6 357 156

Table 3-5—Exploration and Development Expenditures, 1974—1981—Continued

	Physical Work and Surveys	Administration, Overhead, Land Costs, Etc.	Construction, Machinery and Equipment, Other Capital Costs	Totals
B. Exploration on Declared or Operating Mines—Continued	$	$	$	$
Others—				
1974	4 236			4 236
1975	36 242	2 700		38 942
1976	214 081	30 000		244 081
1977	106 896	403 300		510 196
1978	12 025			12 025
1979	35 200		1 300	36 500
1980	187 332			187 332
1981	60 300	7 350		67 650
Totals—				
1974	3 144 787	866 483	278 500	4 289 770
1975	3 828 620	3 092 835		6 921 455
1976	9 238 494	141 304		9 379 798
1977	9 073 305	27 538 559		36 611 864
1978	10 627 711	2 240 014		12 867 725
1979	10 357 894	1 984 160	264 886	12 606 940
1980	39 404 773	12 856 108	2 551 716	54 812 597
1981	13 627 965	822 834	8 000	14 458 799
C. Development on Declared Mines				
Metal mines—				
1974	1 280 513	1 028 199	1 985 000	4 293 712
1975		57 166	840 344	897 510
1976	512 197	974 985	12 447 569	13 934 751
1977	380 419	1 132 316	33 672 153	35 184 888
1978	133 335	895 892		1 029 227
1979	3 482 962	1 351 567	54 559 204	59 393 733
1980	83 119 989	736 527	23 446 243	107 302 759
1981	19 072 107	6 888 019	29 993 101	55 953 227
Coal mines—				
1974	320 098	256 055	111 500	687 653
1975				
1976	1 425 312	583 304		2 008 616
1977	1 725 484	247 313		1 972 797
1978	30 957	38 910		69 867
1979	981 517	350 157		1 331 674
1980	3 296 000	69 000	43 280 261	46 645 261
1981	7 812 359	1 771 320	115 229 391	124 813 070
Others—				
1974	23 242	37 988	2 883 584	2 944 814
1975				
1976		3 155	18 001 500	18 004 655
1977	64 689	708	40 000	105 397
1978	7 045	2 159	10 000	19 204
1979				
1980				
1981				
Totals—				
1974	1 623 853	1 322 242	4 980 084	7 926 179
1975		57 166	840 344	897 510
1976	1 937 509	1 561 444	30 449 069	33 948 022
1977	2 170 592	1 380 337	33 712 153	37 263 082
1978	171 337	936 961	10 000	1 118 298
1979	4 464 479	1 701 724	54 559 204	60 725 407
1980	86 415 989	805 527	66 726 504	153 948 020
1981	26 884 466	8 659 339	145 222 492	180 766 297

Table 3-5—Exploration and Development Expenditures, 1974—1981—Continued

	Physical Work and Surveys	Administration, Overhead, Land Costs, Etc.	Construction, Machinery and Equipment, Other Capital Costs	Totals
D. Development on Operating Mines	$	$	$	$
Metal mines—				
1974	20 933 501	1 722 680	46 732 326	69 388 507
1975	9 013 375	5 804 924	24 548 602	39 366 901
1976	6 937 229	404 226	41 881 126	49 222 581
1977	14 491 378	1 722 479	45 859 006	62 072 863
1978	10 424 872	575 164	17 908 816	28 908 852
1979	27 395 046	2 672 011	67 831 381	97 898 438
1980	33 379 015	2 541 622	250 726 066	286 646 703
1981	96 533 183	9 803 477	312 609 605	418 946 265
Coal mines—				
1974	9 027 818		16 607 506	25 635 324
1975	3 300 000		59 000 000	62 300 000
1976	16 043 383	55 377	20 767 397	36 866 157
1977	30 466 894		25 943 377	56 410 271
1978	31 222 528		15 621 757	46 844 285
1979	46 473 678	628 021	40 698 097	87 799 796
1980	63 173 491	762 244	68 817 158	132 752 893
1981	6 092 432	18 779 550	247 123 358	271 995 340
Others—				
1974	6 198 552	146 182	16 606 229	22 950 963
1975	17 350 175	124 860	18 077 384	35 552 419
1976	58 980	79 300	1 389 956	1 528 236
1977	432 731	108 500	931 521	1 472 752
1978	102 248	9 579	1 256 869	1 368 696
1979	187 044	30 700	1 033 645	1 251 389
1980	1 139 216	3 461	2 889 032	4 031 709
1981	702 587		1 272 328	1 974 915
Totals—				
1974	36 159 871	1 868 862	79 946 061	117 974 794
1975	29 663 550	5 929 784	101 625 986	137 219 320
1976	23 039 592	538 903	64 038 479	87 616 974
1977	45 391 003	1 830 979	72 733 904	119 955 886
1978	41 749 648	584 743	34 787 442	77 121 833
1979	74 055 768	3 330 732	109 563 123	186 949 623
1980	97 691 722	3 307 327	322 432 256	423 431 305
1981	103 328 202	28 583 027	561 005 291	692 916 520

Table 3-6—Production of Gold, Silver, Copper, Lead, Zinc, Molybdenum, and Iron Concentrates, 1858–1981

Year	Gold (Placer)		Gold (Fine)		Silver		Copper	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	g	$	g	$	g	$	kg	$
1858–1890	100 978 533	55 192 163	....	....	6 876 531	214 152	....	....
1891–1900	11 703 748	6 397 183	19 682 165	12 858 353	700 977 829	13 561 194	16 064 375	4 365 210
1901–1910	15 787 261	8 628 660	72 224 836	47 998 179	971 114 910	16 973 507	172 344 737	56 384 783
1911–1920	8 656 275	4 731 100	63 112 995	41 942 862	994 340 920	22 572 682	231 326 501	100 770 459
1921	426 733	233 200	4 222 699	2 804 197	83 150 418	1 591 201	17 706 790	4 879 624
1922	674 624	368 800	6 153 915	4 089 684	220 872 076	4 554 781	14 678 125	4 329 754
1923	768 555	420 000	5 575 057	3 704 994	187 643 964	3 718 129	26 181 346	8 323 266
1924	769 799	420 750	7 704 711	5 120 535	259 454 010	5 292 184	29 413 222	8 442 870
1925	512 453	280 092	6 522 890	4 335 069	238 088 613	5 286 818	32 797 475	10 153 269
1926	650 426	355 503	6 264 984	4 163 859	334 312 337	6 675 606	40 523 625	12 324 421
1927	285 868	156 247	5 536 365	3 679 601	325 654 164	5 902 043	40 461 530	11 525 011
1928	262 012	143 208	5 619 130	3 734 609	330 536 775	6 182 461	44 410 233	14 265 242
1929	217 192	118 711	4 516 871	3 002 020	309 791 230	5 278 194	46 626 180	18 612 850
1930	278 527	152 235	5 002 482	3 324 975	352 342 964	4 322 185	41 894 588	11 990 466
1931	534 225	291 992	4 545 175	3 020 837	234 837 945	2 254 979	29 090 879	5 365 690
1932	634 501	395 542	5 649 891	4 263 389	222 406 822	2 264 729	22 955 299	3 228 892
1933	744 233	562 787	6 954 289	6 394 645	218 397 615	2 656 526	19 572 164	3 216 701
1934	783 205	714 431	9 244 309	10 253 952	267 920 527	4 088 280	22 521 530	3 683 662
1035	961 985	895 058	11 363 263	12 856 419	288 323 068	6 005 906	17 884 241	3 073 428
1936	1 349 528	1 249 940	12 583 590	14 172 367	296 944 198	4 309 330	9 830 071	2 053 828
1937	1 684 321	1 558 245	14 331 671	16 122 767	351 630 830	5 073 962	20 891 260	6 023 411
1938	1 796 478	1 671 015	17 340 607	19 613 624	337 827 661	4 722 288	29 832 572	6 558 575
1939	1 547 250	1 478 492	18 267 912	21 226 957	336 577 786	4 381 365	33 227 590	7 392 862
1940	1 215 101	1 236 928	18 149 347	22 461 516	383 436 042	4 715 315	35 371 049	7 865 085
1941	1 361 534	1 385 962	17 760 622	21 984 501	378 700 797	4 658 545	30 134 516	6 700 693
1942	1 023 413	1 041 772	13 825 843	17 113 943	301 011 133	4 000 775	22 723 823	5 052 856
1943	454 104	462 270	6 979 607	8 639 516	265 193 820	3 858 496	19 190 263	4 971 132
1944	355 601	361 977	5 804 815	7 185 332	177 453 003	2 453 293	16 465 584	4 356 070
1945	391 556	398 591	5 454 626	6 751 860	191 510 720	2 893 934	11 726 375	3 244 472
1946	409 219	475 361	3 658 006	4 322 241	197 994 264	5 324 959	7 938 069	2 240 070
1947	216 757	200 585	7 566 800	8 514 870	177 550 262	4 110 092	18 952 760	8 519 741
1948	632 386	585 200	8 902 612	10 018 050	209 016 328	5 040 101	19 515 886	9 616 174
1949	556 308	529 524	8 969 981	10 382 256	237 559 178	5 671 082	24 882 500	10 956 550
1950	595 125	598 717	8 832 723	10 805 553	295 772 610	7 667 950	19 147 001	9 889 458
1951	736 861	717 911	8 126 405	9 627 947	255 632 882	7 770 983	19 617 612	11 980 155
1952	545 982	494 756	7 955 805	8 765 889	274 042 530	7 326 803	19 053 280	13 054 893
1953	443 062	403 230	7 886 228	8 727 294	260 606 407	7 019 272	22 235 441	14 869 544
1954	270 098	238 967	8 036 642	8 803 279	305 630 613	8 154 145	22 747 578	14 599 693
1955	238 436	217 614	7 541 762	8 370 306	245 811 643	6 942 995	20 065 928	16 932 549
1956	120 213	109 450	5 963 782	6 603 628	261 423 017	7 511 866	19 667 923	17 251 872
1957	91 318	80 990	6 948 504	7 495 170	252 847 111	7 077 166	14 237 029	8 170 465
1958	175 732	157 871	6 044 992	6 604 149	218 998 027	6 006 854	5 741 837	2 964 529
1959	235 450	208 973	5 385 360	5 812 511	192 779 535	5 421 417	7 363 374	4 497 991
1960	119 653	107 418	6 394 155	6 979 441	231 612 937	6 600 183	14 997 694	9 583 724
1961	106 248	99 884	4 970 913	5 667 253	229 353 429	6 909 140	14 375 361	8 965 149
1962	103 106	96 697	4 940 712	5 942 101	192 521 474	7 181 907	49 431 850	33 209 215
1963	143 696	135 411	4 820 312	5 650 458	199 764 616	8 861 050	53 635 704	36 238 007
1964	57 292	55 191	4 307 361	5 227 884	163 901 675	7 348 938	52 414 456	38 609 136
1965	26 935	25 053	3 642 908	4 419 089	154 646 729	6 929 793	38 644 540	32 696 081
1966	47 743	44 632	3 717 057	4 506 646	172 594 622	7 729 939	47 990 080	56 438 255
1967	27 713	25 632	3 923 861	4 763 688	192 239 525	10 328 695	78 352 932	88 135 172
1968	20 839	19 571	3 853 537	4 672 242	221 791 325	16 475 795	73 024 968	87 284 148
1969	12 410	11 720	3 654 012	4 427 506	179 169 889	11 100 491	75 937 956	111 592 416
1970	15 272	14 185	3 135 462	3 685 476	202 521 462	12 041 181	96 329 694	124 657 958
1971	5 505	4 647	2 668 046	3 031 844	238 670 301	11 968 046	127 286 040	131 037 918
1972	21 492	26 905	3 782 871	6 995 448	215 420 498	11 519 660	211 832 288	209 403 822
1973	119 156	311 524	5 784 723	18 117 268	236 987 318	19 552 997	317 603 055	582 803 251
1974	45 162	232 512	5 001 082	26 749 083	181 695 950	28 440 365	287 547 048	541 644 913
1975	43 744	232 204	4 819 241	25 082 494	196 305 885	30 545 947	258 497 599	331 693 850
1976	26 064	115 613	5 393 477	21 761 502	239 720 882	32 532 836	263 618 197	378 984 941
1977	46 170	289 075	5 906 336	31 301 931	241 503 007	37 934 098	275 224 115	384 736 661
1978	36 515	295 001	6 542 332	47 951 880	227 271 890	45 071 509	273 692 676	431 694 395
1979	214 106	2 649 918	8 062 810	101 481 156	214 117 518	94 700 656	272 163 001	656 359 923
1980	280 104	6 213 376	7 197 312	163 930 073	203 801 811	156 548 306	264 674 830	670 623 616
1981	291 705	4 540 289	7 468 769	131 542 422	403 754 797	152 420 716	290 088 241	611 282 050
Totals ...	163 966 618	111 868 461	592 201 638	1 081 760 590	17 692 360 655	974 409 883	4 774 374 495	6 042 372 867

Table 3-6—Production of Gold, Silver, Copper, Lead, Zinc, Molybdenum, and Iron Concentrates, 1858–1981—Continued

Year	Lead		Zinc		Molybdenum		Iron Concentrates	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	kg	$	kg	$	kg	$	t	$
1858–1890	473 729	45 527					27 097	70 879
1891–1900	93 002 804	7 581 619					11 820	45 602
1901–1910	184 989 089	17 033 102	5 753 423	894 169			17 738	68 436
1911–1920	191 859 042	21 991 616	118 086 182	19 303 993	11 946	36 698	3 358	18 510
1921	18 779 664	1 693 354	22 416 133	1 952 065			916	5 050
1922	30 593 731	3 480 306	25 921 103	2 777 322			1 089	3 600
1923	43 845 439	6 321 770	26 464 465	3 278 903			220	1 337
1924	77 284 697	12 415 917	35 893 017	4 266 741				
1925	107 908 698	18 670 329	44 568 438	7 754 450				
1926	119 305 027	17 757 535	64 807 554	10 586 610				
1927	128 364 347	14 874 292	65 872 809	8 996 135				
1928	138 408 812	13 961 412	82 445 946	9 984 613			18	
1929	139 705 336	15 555 189	78 061 406	9 268 792				
1930	145 966 952	12 638 198	113 614 910	9 017 005				
1931	118 796 232	7 097 812	91 657 703	5 160 911				
1932	114 308 115	5 326 432	87 143 752	4 621 641				
1933	123 235 512	6 497 719	88 887 198	6 291 416				
1934	157 562 183	8 461 859	113 013 038	7 584 199				
1935	156 156 723	10 785 930	116 227 650	7 940 860				
1936	171 444 146	14 790 028	115 475 574	8 439 373				
1937	190 107 902	21 417 049	132 081 905	14 274 245				
1938	187 323 227	13 810 024	135 395 388	9 172 822				
1939	171 794 338	12 002 390	126 283 585	8 544 375				
1940	211 758 009	15 695 467	141 529 456	10 643 026				
1941	207 218 262	15 358 976	166 861 962	12 548 031				
1942	230 060 714	17 052 054	175 646 590	13 208 636				
1943	199 196 604	16 485 902	152 474 485	13 446 018				
1944	132 866 893	13 181 530	126 126 765	11 956 725				
1945	152 849 156	16 848 823	133 714 538	18 984 581				
1946	156 879 853	23 345 731	124 406 109	21 420 484				
1947	142 306 192	42 887 313	114 761 068	28 412 593				
1948	145 165 821	57 734 770	122 610 001	37 654 211			616	1 735
1949	120 373 215	41 929 866	130 736 145	38 181 214			4 964	27 579
1950	128 830 683	41 052 905	131 697 238	43 769 392				
1951	124 037 181	50 316 015	153 091 761	67 164 754			102 997	790 000
1952	129 250 197	45 936 692	169 130 882	59 189 656			816 898	5 474 924
1953	135 008 129	39 481 244	173 407 848	40 810 618			899 240	6 763 105
1954	150 807 088	45 482 505	151 555 559	34 805 755			486 018	3 733 891
1955	137 241 656	45 161 245	194 600 177	52 048 909			554 223	3 228 756
1956	128 691 681	44 702 619	201 327 284	58 934 801			335 616	2 190 847
1957	127 732 462	39 568 086	203 787 462	50 206 681			324 174	2 200 637
1958	133 615 439	34 627 075	195 952 146	43 234 839			571 769	4 193 442
1959	130 372 360	33 542 306	182 498 693	44 169 198			770 421	6 363 848
1960	151 321 570	38 661 912	182 977 897	50 656 726	2 456	9 500	1 052 651	10 292 847
1961	174 307 617	42 313 569	175 970 780	45 370 891			1 211 147	12 082 540
1962	152 000 806	34 537 454	187 528 084	51 356 376			1 627 342	18 326 911
1963	142 869 197	37 834 714	182 734 698	53 069 163			1 869 009	20 746 424
1964	121 896 644	39 402 293	181 797 313	58 648 561	12 812	47 063	1 816 684	20 419 487
1965	113 480 794	43 149 171	141 179 547	48 666 933	3 306 274	12 405 344	1 964 410	21 498 581
1966	95 929 798	34 436 934	138 401 395	47 666 540	7 754 088	27 606 061	1 952 074	20 778 934
1967	94 406 546	31 432 079	119 217 472	39 248 539	7 945 782	31 183 064	1 954 468	20 820 765
1968	105 063 971	32 782 257	135 803 151	43 550 181	8 980 988	32 552 722	1 900 311	21 437 569
1969	95 286 815	33 693 539	134 565 199	46 639 024	12 064 350	47 999 442	1 882 266	19 787 845
1970	97 448 607	35 096 021	125 005 208	44 111 055	14 186 706	52 561 796	1 704 650	17 391 883
1971	112 865 575	34 711 408	138 549 629	49 745 789	9 926 694	36 954 846	1 750 738	18 153 612
1972	88 109 663	28 896 566	121 719 968	47 172 894	12 719 391	43 260 349	1 139 698	11 642 379
1973	84 890 924	30 477 936	137 380 768	62 564 751	13 785 264	51 851 509	1 420 160	12 906 063
1974	55 252 692	23 333 016	77 733 732	59 582 753	13 789 825	60 791 552	1 306 930	12 742 227
1975	70 603 483	24 450 158	99 668 230	80 572 872	13 026 627	71 201 391	1 305 840	15 273 878
1976	85 407 582	32 796 533	106 498 987	65 499 108	14 088 686	94 109 138	1 255 277	14 760 526
1977	78 172 646	42 316 293	103 780 228	61 301 001	15 521 970	142 057 947	445 317	7 362 345
1978	81 064 539	51 640 564	95 618 111	52 048 701	13 055 203	167 714 272	615 569	11 597 462
1979	84 451 905	88 100 363	88 418 642	61 890 891	10 766 497	321 228 104	668 026	13 008 475
1980	76 709 447	66 096 223	67 481 328	49 363 417	11 179 501	288 934 398	653 324	13 670 233
1981	84 854 093	61 529 276	79 214 552	67 026 535	12 933 224	198 240 391	602 272	14 274 498
Totals	8 081 948 334	1 832 288 812	7 657 312 267	2 046 653 463	195 058 284	1 680 745 587	35 027 355	384 159 662

Table 3-7A—Mineral Production by Mining

Division	Period	Placer Gold		Metals	Industrial Minerals	Structural Materials
		Quantity	Value			
		g	$	$	$	$
Alberni	1980			43 126 081		2 355 915
	1981			**35 031 245**		**1 022 903**
	To Date	50 294	33 253	405 594 317	9 398	12 143 483
Atlin	1980	41 917	922 991	5 043		83 380
	1981	**110 462**	**1 702 439**			
	To Date	23 194 691	21 327 440	38 284 095	20 325	490 569
Cariboo	1980	21 841	483 773	125 949 023	138 273	15 887 804
	1981	**27 919**	**425 559**	**114 797 674**	**155 232**	**10 525 348**
	To Date	81 337 175	55 668 550	854 102 058	1 324 514	88 033 077
Clinton	1980	445	9 882	52		4 120 626
	1981	**68**	**1 306**			**1 221 542**
	To Date	317 837	266 048	848 429	162 427	15 771 663
Fort Steele	1980			150 637 943	5 149 520	2 901 123
	1981			**142 573 081**	**5 292 407**	**1 367 308**
	To Date	639 241	472 087	3 247 702 437	40 151 239	19 980 299
Golden	1980	1 816	40 371	300	5 388 986	830 648
	1981			**773 000**	**6 214 000**	**571 867**
	To Date	16 403	51 639	67 075 470	43 873 924	6 667 293
Greenwood	1980	15	334	6 733 108	90 000	1 109 268
	1981			**4 280 000**	**240 171**	**502 807**
	To Date	159 178	132 270	261 233 247	2 770 107	5 909 984
Kamloops	1980	11 230	249 675	373 926 394	2 000	22 854 137
	1981			**305 865 034**		**29 147 581**
	To Date	883 329	1 021 423	2 085 260 197	6 542 538	156 786 251
Liard	1980	18 121	402 878	10 600 895	91 483 287	9 012 362
	1981	**200**	**33 398**	**9 526 445**	**96 095 067**	**6 022 708**
	To Date	1 598 515	1 874 445	47 706 756	744 499 379	45 523 977
Lillooet	1980	229	5 090	8 487		535 474
	1981			**220 684**		**999 509**
	To Date	2 893 995	1 948 000	148 503 017	473 095	6 381 183
Nanaimo	1980			203 359 927	81 525	15 281 173
	1981			**161 681 207**	**100 448**	**12 676 744**
	To Date	30 735	65 239	1 338 270 978	1 140 391	150 838 459
Nelson	1980			293 440	1 567 334	3 450 862
	1981			**107 157**	**1 460 492**	**2 877 228**
	To Date	111 535	89 026	409 715 211	12 444 852	22 357 774
New Westminster	1980					29 653 102
	1981					**41 160 726**
	To Date	975 418	597 152	63 768 973	1 611 625	394 160 856
Nicola	1980			29 043 182		532 380
	1981			**21 118 849**		**584 125**
	To Date	7 278	4 764	509 412 037	10 050	4 527 159
Omineca	1980			227 748 617	651 740	14 363 353
	1981	**13 809**	**280 533**	**251 590 248**	**109 578**	**2 045 034**
	To Date	1 771 734	1 782 872	1 630 937 883	2 123 893	38 322 512
Osoyoos	1980	1 743	38 750	75 542 631	33 873	755 390
	1981			**58 184 063**	**46 569**	**529 628**
	To Date	9 472	47 402	699 134 197	6 881 883	9 180 460
Revelstoke	1980	2 747	55 326	20 416		3 319 530
	1981	**1 256**	**22 557**	**51**		**1 135 729**
	To Date	240 317	252 421	15 523 881		9 587 341
Similkameen	1980	442	9 820	90 503 650		690 812
	1981	**311**	**3 500**	**60 731 851**		**19 355**
	To Date	1 418 222	916 258	563 782 710	18 558	6 939 590
Skeena	1980			20 285 440		18 147 539
	1981			**39 042 526**		**3 235 355**
	To Date	143 447	108 951	763 914 643	1 240 215	54 194 745
Slocan	1980			10 341 620		451 006
	1981			**7 383 817**		**551 366**
	To Date	11 384	9 397	311 291 782		4 502 895
Trail Creek	1980			56 995		1 331 588
	1981			**10 977**		**909 341**
	To Date	26 469	24 260	91 129 275		8 488 108
Vancouver	1980			13 836 716		65 548 358
	1981			**9 652 210**		**67 611 299**
	To Date	6 026	9 723	355 612 782	7 066 964	429 701 037
Vernon	1980	7 984	177 496	6 635	10 573	4 003 676
	1981			**20 658**		**2 984 517**
	To Date	116 328	532 340	398 707	244 239	29 401 569
Victoria	1980					24 516 151
	1981					**12 864 487**
	To Date	19 533	15 680	24 812 286	190 811	423 956 993
Not Assigned	1980	171 574	3 816 990	40 762 209	11 328 896	
	1981	**137 680**	**2 100 999**	**19 435 624**	**12 750 878**	**137 772**
	To Date	47 988 062	24 597 821	468 091 073	105 582 041	79 076 879
Totals	1980	280 104	6 213 376	1 422 788 804	115 926 007	242 325 657
	1981	**291 705**	**4 540 289**	**1 242 142 246**	**122 464 842**	**200 796 279**
	To Date	163 966 618	111 868 461	14 402 106 441	980 582 468	2 022 924 156

Divisions, 1980 and 1981, and Total to Date

Coal		Crude Oil and Condensates		Natural Gas Delivered to Pipeline		Butane and Propane		Division Totals
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
t	$	m^3	$	10^3m^3	$	m^3	$	$
								15 481 996
								36 054 148
								417 780 451
								1 011 414
								1 810 284
								60 122 429
								142 458 873
								125 903 813
263	1 100							999 149 299
								4 130 560
								1 222 848
								17 048 567
10 823 370	461 487 983							620 176 569
11 666 057	**553 212 329**							**702 445 125**
148 446 556	3 434 390 571							6 742 696 633
								6 260 305
								7 558 867
								117 668 326
								7 932 710
								5 030 978
								270 045 608
								397 032 206
								335 012 615
13 687	59 765							2 249 670 174
		2 172 584	204 692 901	8 931 833	612 545 107	165 063	11 064 618	939 802 048
75 070	**998 350**	**2 188 770**	**252 687 843**	**8 062 681**	**616 795 096**	**148 753**	**15 033 145**	**997 191 952**
206 993	2 513 857	58 377 614	1 831 363 470	154 065 277	3 678 466 044	13 280 390	75 130 685	6 427 078 613
								549 051
								1 220 193
								157 305 295
								218 722 625
								174 458 399
67 425 673	301 144 744							1 793 459 811
								5 311 636
								4 444 877
								144 606 863
								29 653 102
								41 642 726
								460 138 606
								29 575 562
								21 702 974
2 657 660	11 080 836							525 034 846
160	4 874							242 768 584
11 494	**60 613**							**254 056 006**
468 846	3 517 565							1 676 884 725
								76 370 644
								58 760 260
1 018	5 008							715 248 950
								3 395 272
								1 158 337
								25 363 643
								91 204 282
								66 754 706
4 188 851	19 553 725							591 210 841
								38 432 979
								42 277 881
35	116							819 458 670
								10 792 626
								7 935 183
								115 804 074
								1 388 583
								520 318
								99 641 643
								79 375 074
								77 263 509
								792 390 506
								4 798 380
								3 005 175
								30 576 855
								24 516 151
								12 864 407
								448 975 770
								55 908 095
								34 425 271
								667 347 814
10 823 530	461 492 857	2 172 584	204 692 901	8 931 833	612 545 107	165 063	11 064 618	3 077 049 327
11 752 621	**554 271 292**	**2 188 770**	**252 687 843**	**8 062 681**	**616 795 096**	**148 753**	**15 033 145**	**3 088 721 032**
223 409 580	3 772 267 287	58 377 614	1 831 363 470	154 065 227	3 678 466 044	13 280 390	75 130 685	26 874 709 012

Table 3-7B—Production of Lode Gold, Silver, Copper, Lead and Zinc by Mining Divisions, 1980 and 1981, and Total to Date

Division	Period	Lode Gold		Silver		Copper		Lead		Zinc		Division Total
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	
		g	$	g	$	kg	$	kg	$	kg	$	$
Alberni	1980	400 124	9 773 483	16 844 804	13 346 692	1 712 743	4 767 999	1 335 991	1 581 808	14 929 824	13 518 379	42 988 361
	1981	**532 429**	**8 330 133**	**24 359 317**	**8 628 462**	**2 188 285**	**3 666 551**	**1 952 720**	**1 421 054**	**13 250 339**	**12 937 198**	**34 983 398**
	To Date	16 852 728	57 329 402	349 470 459	64 897 525	54 056 772	74 121 729	24 820 089	13 890 261	238 816 249	141 751 609	351 990 526
Atlin	1980			10 111	5 043							5 043
	1981	**229**	**3 685**	**236 460**	**89 675**	**173**	**260**	**14 522**	**10 805**	**3 945**	**3 392**	**107 817**
	To Date	10 706 876	12 135 261	106 031 575	3 092 370	11 239 185	8 160 621	10 833 419	3 464 687	41 313 775	10 869 006	37 721 945
Cariboo	1980	137 273	3 145 495	4 238 531	3 869 147	31 480 649	84 349 457	8 828	7 201	2 215	1 221	91 372 521
	1981	**247 177**	**4 130 658**	**4 980 886**	**2 275 795**	**42 554 665**	**91 902 271**					**98 308 724**
	To Date	37 778 063	50 623 449	34 545 468	10 888 727	351 457 977	629 843 201	20 718	11 196	2 445	1 241	691 367 814
Clinton	1980			99	52							52
	1981											
	To Date	727 499	827 328	982 518	14 289	26 103	5 905	88	7			847 529
Fort Steele	1980			77 631 542	60 959 612			69 402 033	59 222 917	41 827 743	28 017 318	148 199 847
	1981			**104 997 686**	**40 581 052**			**78 978 563**	**56 963 852**	**52 847 971**	**42 572 603**	**140 117 507**
	To Date	390 707	749 363	8 319 880 551	386 728 829	7 163 855	12 534 149	6 829 987 603	1 532 151 936	5 168 053 142	1 257 937 037	3 190 101 314
Golden	1980			568	300							300
	1981	**210**	**3 000**	**1 583 000**	**479 000**	**2 600**	**4 000**	**271 962**	**169 000**	**161 957**	**117 000**	**772 000**
	To Date	14 199	28 757	145 133 213	5 422 871	534 700	371 849	118 229 049	26 466 805	152 500 635	33 583 756	65 874 038
Greenwood	1980	2 633	61 700	10 009 486	6 527 024	35	86	81 232	66 299	107 285	76 120	6 731 229
	1981	**8 700**	**162 500**	**11 259 241**	**3 902 843**	**30**	**56**	**130 349**	**106 820**	**134 301**	**114 395**	**4 286 614**
	To Date	43 577 796	40 907 775	1 429 462 470	60 501 273	273 352 646	153 550 575	12 123 987	3 069 238	11 969 996	2 990 680	261 019 541
Kamloops	1980	1 483 262	34 591 453	29 715 994	22 603 193	107 300 372	264 670 221					321 864 866
	1981	**1 152 943**	**21 401 265**	**26 912 273**	**9 795 740**	**105 302 957**	**219 762 493**					**250 959 498**
	To Date	7 983 351	91 521 632	262 350 385	67 159 288	994 335 872	1 682 282 960	401 143	122 559	245 652	53 388	1 841 139 827
Liard	1980	469 205	10 598 427	4 582	2 468							10 600 895
	1981	**519 895**	**9 526 336**	**313**	**109**							**9 526 445**
	To Date	1 550 020	28 284 804	548 863	270 980	13 570 392	19 147 861	7 428	2 736	804	296	47 706 677
Lillooet	1980	373	8 401	136	86							8 487
	1981	**12 395**	**218 945**	**3 826**	**1 583**			**50**	**39**	**137**	**117**	**220 684**
	To Date	130 210 423	147 692 517	30 734 445	721 654	181	41	28 413	2 587	144	119	148 416 918
Nanaimo	1980	1 695 233	41 421 615	12 110 947	10 354 583	47 839 401	126 778 320					178 554 518
	1981	**1 603 384**	**29 278 372**	**11 095 991**	**5 201 415**	**50 746 733**	**109 240 473**					**143 720 260**
	To Date	22 340 614	145 802 384	153 121 956	31 472 489	532 522 751	910 067 092					1 087 341 965
Nelson	1980	11 849	277 075	18 275	11 936	62	66	3 909	3 252	2 012	1 109	293 440
	1981	**6 317**	**103 111**	**9 244**	**3 010**	**80**	**120**	**1 085**	**665**	**292**	**251**	**107 157**
	To Date	41 762 053	42 559 442	324 115 026	9 142 504	6 765 621	1 689 384	240 837 922	69 419 737	686 788 568	223 722 156	346 533 223
New Westminster	1980											
	1981											
	To Date	140 160	131 544	470 246	7 729	11 333 143	11 553 105	12 003	1 119	5 786	481	11 693 978
Nicola	1980	13 374	342 795	4 230	2 716	10 409 840	27 182 299	146	119	85	71	27 528 000
	1981	**-13 312**	**-344 041**			**9 170 160**	**19 930 264**					**19 586 223**
	To Date	343 376	396 641	8 605 983	140 939	388 919 123	498 266 589	1 017 092	91 649	147 156	11 135	498 906 953

Omineca	1980	1 188 153	24 141 931	5 036 463	3 058 492	29 271 503	69 819 980	15 718	12 822	22 664	12 491	97 045 726
	1981	**1 988 334**	**32 653 195**	**174 584 518**	**65 293 111**	**36 993 915**	**77 887 156**	**35 945**	**23 774**	**39 083**	**31 358**	**175 888 594**
	To Date	14 404 193	111 241 521	554 577 095	85 902 844	354 162 467	943 492 105	13 882 217	3 986 798	19 690 980	6 237 272	800 860 540
Osoyoos	1980	75 214	1 967 780	6 976 261	4 788 945	8 784 006	21 991 126	2 414	2 185	8 421	4 517	28 754 563
	1981	**99 758**	**1 622 758**	**7 753 882**	**2 454 943**	**10 812 068**	**22 129 936**	**887**	**856**	**2 366**	**2 447**	**26 210 940**
	To Date	53 613 315	62 403 827	221 137 110	32 858 971	159 901 413	253 170 191	305 732	102 008	202 376	79 989	348 614 986
Revelstoke	1980	187	3 600	18 059	12 000			4 922	4 011	1 303	805	20 416
	1981			**132**	**51**							**51**
	To Date	1 163 843	1 088 308	128 335 576	2 833 636	69 710	51 037	16 411 486	3 880 101	12 315 621	3 317 982	11 171 064
Similkameen	1980	1 023 740	23 068 167	3 448 082	2 609 833	25 258 903	64 625 650					90 503 650
	1981	**719 081**	**12 833 471**	**3 272 303**	**1 304 842**	**22 259 089**	**46 993 538**					**60 731 851**
	To Date	14 040 280	80 615 015	161 850 062	10 651 282	470 731 349	472 363 905	178 550	15 137	36 494	5 258	563 650 597
Skeena	1980	58 439	1 296 192	2 866 808	2 089 018	2 118 762	5 284 208	143	436	19 461	10 055	8 679 909
	1981	**280 634**	**3 670 373**	**6 812 999**	**2 488 081**	**9 633 517**	**19 569 280**	**288**	**166**	**1 896**	**2 080**	**25 729 980**
	To Date	78 420 372	76 377 641	2 296 803 951	66 098 468	524 202 612	419 756 371	27 255 173	5 470 143	7 859 388	2 573 360	570 277 983
Slocan	1980	1 925	39 805	11 320 150	8 577 250	522	575	827 676	896 375	770 380	795 762	10 309 767
	1981	**4 575**	**74 988**	**12 221 051**	**5 036 250**			**1 263 752**	**1 246 680**	**682 011**	**1 006 638**	**7 364 476**
	To Date	604 457	982 349	2 501 643 673	81 119 960	7 053	2 758	519 065 760	112 516 389	437 224 231	110 754 165	305 375 251
Trail Creek	1980	2 582	56 295	1 462	700							56 995
	1981	**684**	**10 577**	**1 244**	**400**							**10 977**
	To Date	92 885 611	63 651 984	117 186 744	2 532 404	44 942 776	18 245 404	175 629	61 660	198 043	87 750	84 579 212
Vancouver	1980	543 015	11 353 811	1 723 747	1 090 495	38 878	71 717	723 511	591 279	997 635	729 419	13 836 716
	1981	**466 347**	**7 879 680**	**1 327 280**	**512 730**	**26 867**	**38 389**	**579 294**	**413 310**	**903 606**	**806 270**	**9 652 210**
	To Date	20 328 435	62 155 864	197 411 264	9 743 071	507 096 964	243 138 405	12 798 684	4 941 727	113 446 353	34 427 549	354 406 706
Vernon	1980	204	4 924	2 982	1 711							6 635
	1981	**179**	**3 144**	**51 495**	**16 556**			**892**	**590**	**428**	**368**	**20 658**
	To Date	165 633	189 982	2 301 203	166 560	297	100	87 255	29 866	13 939	11 667	398 175
Victoria	1980											
	1981											
	To Date	1 375 157	1 236 720	29 478 396	654 567	29 775 654	22 561 791	95 288	19 848	1 618 731	283 923	24 776 849
Not Assigned	1980	90 527	1 777 114	21 818 488	16 637 015	459 055	861 901	4 302 844	3 707 519	8 792 300	6 196 150	29 199 699
	1981	**1 198**	**19 728**	**11 492 536**	**4 355 068**	**397 094**	**555 352**	**1 615 936**	**1 171 745**	**11 186 220**	**9 432 498**	**15 494 935**
	To Date	822 477	2 827 070	317 582 123	41 387 013	27 555 672	17 973 647	253 372 706	52 570 620	764 842 649	217 953 654	332 712 004
Total	1980	7 197 312	163 930 073	203 801 811	156 548 306	264 674 830	670 623 616	76 709 447	66 086 223	67 481 328	49 363 417	1 106 561 635
	1981	**7 468 769**	**131 542 422**	**403 754 797**	**152 430 716**	**290 088 241**	**611 282 050**	**84 854 093**	**61 529 276**	**79 214 552**	**67 026 535**	**1 023 880 999**
	To Date	592 201 698	1 081 760 598	17 692 360 655	974 409 883	4 774 374 495	6 042 372 867	8 081 948 334	1 632 288 812	7 657 312 267	2 046 653 463	11 977 485 615

Table 3-7C—Production of Miscellaneous Metals by Mining Divisions, 1980 and 1981, and Total to Date

Division	Period	Antimony		Bismuth		Cadmium		Chromite		Iron Concentrates		Manganese		Mercury	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		kg	$	kg	$	kg	$	t	$	t	$	t	$	kg	$
Alberni	1980					22 729	137 720								
	1981					**13 600**	**47 847**								
	To Date					619 274	3 969 080			4 293 517	49 634 711				
Atlin	1980														
	1981					**8**	**28**								
	To Date					144 799	561 790								
Cariboo	1980														
	1981														
	To Date														
Clinton	1980														
	1981														
	To Date							114	900						
Fort Steele	1980									27 476	549 520				
	1981									**28 181**	**639 427**				
	To Date					1 542 022	10 064 486			1 417 505	16 912 983				
Golden	1980														
	1981					**492**	**1 000**								
	To Date	18 172	14 906			259 654	1 186 526								
Greenwood	1980					328	1 897								
	1981					**312**	**1 306**								
	To Date					37 927	182 311	608	31 395						
Kamloops	1980														
	1981														
	To Date					99	641			19 204	95 851			4 984	5 795
Liard	1980														
	1981														
	To Date														
Lillooet	1980														
	1981														
	To Date	6 108	4 321											4 187	41 304
Nanaimo	1980														
	1981														
	To Date									15 872 977	152 633 401				
Nelson	1980														
	1981														
	To Date					4 059 962	19 859 034								
New Westminster	1980														
	1981														
	To Date														
Nicola	1980									44 211	1 515 182				
	1981									**40 778**	**1 532 626**				
	To Date									428 558	10 505 084				

Omineca	1980														
	1981														
	To Date	53 697	21 882			135 245	628 342							6 085 216	49 171 164
Osoyoos	1980														
	1981														
	To Date											15			
Revelstoke	1980														
	1981														
	To Date	4 261	3 455			46 997	176 102								
Similkameen	1980														
	1981														
	To Date														
Skeena	1980									581 637	11 605 531				
	1981									**533 313**	**12 102 445**				
	To Date					64 360	316 764			12 995 095	154 375 707				
Slocan	1980					1 810	31 853								
	1981					**1 637**	**19 341**								
	To Date	14 453	8 133			1 245 620	5 900 238					491	8 160		
Trail Creek	1980														
	1981														
	To Date					52	210			499	1 925				
Vancouver	1980														
	1981														
	To Date					257 261	1 206 076								
Vernon	1980														
	1981														
	To Date					86	532								
Victoria	1980														
	1981														
	To Date					3 175	10 929					1 058	24 508		
Not Assigned	1980	78 654	416 080	23 501	136 306	67 493	389 227								
	1981	**68 323**	**360 745**	**47 300**	**102 641**	**85 913**	**301 555**								
	To Date	27 367 046	28 964 526	3 365 861	16 412 299	12 499 470	45 276 426								
Totals	1980	78 654	416 080	23 501	136 306	92 360	560 679			653 324	13 670 233				
	1981	**68 323**	**360 745**	**47 300**	**102 641**	**101 962**	**371 077**			**602 272**	**14 274 498**				
	To Date	27 463 737	29 017 223	3 365 861	16 412 299	20 916 003	89 339 487	722	32 295	35 027 355	384 159 662	1 564	32 668	6 094 387	49 218 263

Table 3-7C—Production of Miscellaneous Metals by Mining Divisions, 1980 and 1981, and Total to Date—Continued

Division	Period	Molybdenum		Nickel		Palladium		Platinum		Tin		Tungsten (WO$_3$)		Other Value	Division Total
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
		kg	$	kg	$	kg	$	g	$	kg	$	kg	$	$	$
Alberni	1980														137 720
	1981														**47 847**
	To Date														53 603 791
Atlin	1980											132	360		
	1981														**28**
	To Date														562 150
Cariboo	1980	1 298 267	34 576 502												34 576 502
	1981	**1 393 361**	**16 488 950**												**16 488 950**
	To Date	17 239 442	162 709 861					1 883	2 952			12 564	21 431		162 734 244
Clinton	1980														
	1981														
	To Date														900
Fort Steele	1980									108 035	1 888 576				2 438 096
	1981									**124 213**	**1 816 147**				**2 455 574**
	To Date									9 636 779	30 535 470			88 184[1]	57 601 123
Golden	1980														
	1981														**1 000**
	To Date														1 201 432
Greenwood	1980														1 897
	1981														**1 386**
	To Date														213 706
Kamloops	1980	2 261 435	52 061 528												52 061 528
	1981	**3 169 421**	**54 985 536**												**54 985 536**
	To Date	18 149 173	244 018 083												244 120 370
Liard	1980														
	1981														
	To Date							62	79						79
Lillooet	1980														
	1981														
	To Date	666	2 440					93	113			14 675	37 921		86 099
Nanaimo	1980	1 113 074	24 805 409												24 805 409
	1981	**1 266 788**	**17 960 947**												**17 960 947**
	To Date	8 003 152	98 295 612												250 929 013
Nelson	1980														
	1981														
	To Date	6 819	18 378									8 056 095	43 304 576		63 181 988
New Westminster	1980														
	1981														
	To Date			23 337 783	51 698 754									376 241[2]	52 074 995
Nicola	1980														1 515 182
	1981														**1 532 626**
	To Date														10 505 084

Omineca	1980	4 651 559	130 702 891												130 702 891
	1981	**3 420 413**	**75 701 654**												**75 701 654**
	To Date	95 935 731	775 557 671					93	154			1 002 839	4 697 710	420[3]	830 077 343
Osoyoos	1980	1 855 166	46 788 068												46 788 068
	1981	**3 134 312**	**31 973 123**												**31 973 123**
	To Date	41 859 754	350 519 211												350 519 211
Revelstoke	1980														
	1981														
	To Date	1 190 713	4 167 573									3 531	5 687		4 352 817
Similkameen	1980														
	1981														
	To Date							40 246	132 113						132 113
Skeena	1980														11 605 531
	1981	**548 929**	**1 210 181**												**13 312 626**
	To Date	11 019 864	38 942 469									166	331	1 389[3]	193 636 660
Slocan	1980														31 853
	1981														**19 341**
	To Date														5 916 531
Trail Creek	1980														
	1981														
	To Date	1 652 970	6 514 289			23 296	30 462	1 649	3 177						6 550 063
Vancouver	1980														
	1981														
	To Date														1 206 076
Vernon	1980														
	1981														
	To Date														532
Victoria	1980														
	1981														
	To Date														35 437
Not Assigned	1980									31 482	550 305			10 070 592	11 562 510
	1981									**26 128**	**381 991**			**2 793 757**	**3 940 689**
	To Date							16	213	312 665	3 264 100			41 461 505	135 379 069
Totals	1980	11 209 501	288 934 398							139 517	2 438 881			10 070 592	316 227 169
	1981	**12 933 224**	**198 240 391**							**150 341**	**2 198 138**			**2 793 757**	**218 341 247**
	To Date	195 058 284	1 680 745 587	23 337 783	51 698 754	23 296	30 462	44 042	138 801	9 949 444	33 799 570	9 090 002	48 068 016	41 927 739	2 424 620 826

[1] Magnesium, page 67.

[2] Cobalt, page 64.

[3] Selenium, page 69.

Table 3-7D—Production of Industrial Minerals by

Division	Period	Asbestos		Barite[1]		Diatomite		Fluxes (Quartz and Limestone)		Granules (Quartz, Limestone, and Granite)	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		t	$	t	$	t	$	t	$	t	$
Alberni	1980										
	1981										
	To Date										
Atlin	1980										
	1981										
	To Date										
Cariboo	1980					3 615	138 273				
	1981					**3 600**	**155 232**				
	To Date					33 433	1 181 034			44	168
Clinton	1980										
	1981										
	To Date										
Fort Steele	1980										
	1981										
	To Date			7	80						
Golden	1980							61	1 037		
	1981							**28 819**	**409 230**		
	To Date			398 388	4 489 227			31 909	423 995		
Greenwood	1980									1 977	90 000
	1981									**4 330**	**240 171**
	To Date							1 624 308	1 540 319	9 408	446 210
Kamloops	1980									136	2 000
	1981										
	To Date									703	14 230
Liard	1980	100 089	81 688 936								
	1981	**90 914**	**76 770 285**								
	To Date	1 794 403	685 956 188								
Lillooet	1980										
	1981										
	To Date										
Nanaimo	1980							20 500	81 525		
	1981							**19 494**	**100 448**		
	To Date							1 089 885	2 363 242	31 506	777 149
Nelson	1980									28 125	1 567 334
	1981									**22 493**	**1 460 492**
	To Date							6 895	8 174	305 605	12 380 777
New Westminster	1980										
	1981										
	To Date									99 490	1 611 625
Nicola	1980										
	1981										
	To Date										
Omineca	1980									26	1 740
	1981									**133**	**9 578**
	To Date									307	22 551
Osoyoos	1980									1 129	33 873
	1981									**1 341**	**46 569**
	To Date							728 113	3 699 031	197 402	2 850 381
Similkameen	1980										
	1981										
	To Date										
Skeena	1980										
	1981										
	To Date							545 232	1 050 722		
Vancouver	1980										
	1981										
	To Date									26 936	418 606
Vernon	1980							12	10 573		
	1981										
	To Date							2 926	49 298	7 210	190 963
Victoria	1980										
	1981										
	To Date							286	3 505	8 713	157 080
Not Assigned	1980										
	1981										
	To Date										
Totals	1980	100 089	81 688 936			3 615	138 273	20 573	93 135	31 393	1 694 947
	1981	**90 914**	**76 770 285**			**3 600**	**155 232**	**48 313**	**509 678**	**28 297**	**1 756 810**
	To Date	1 794 403	685 956 188	398 395	4 489 307	33 433	1 181 034	4 029 554	9 138 286	687 324	18 869 740

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[1] From 1972, excludes production which is confidential.
Other: *See* notes on individual materials listed alphabetically on pages 62 to 71.

[2] Natro-alunite.

[3] Hydromagnesite.

[4] Volcanic ash.

[5] Magnesium sulphate.

[6] Sodium carbonate.

[7] Phosphate rock

Mining Divisions, 1980 and 1981, and Total to Date

Gypsum and Gypsite		Jade		Mica		Sulphur		Other, Value	Division Total
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value		
t	$	kg	$	t	$	t	$	$	$
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	9 398[2]	9 398
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	20 325[3]	20 325
...	...	...	...	...	...	...	...	...	138 273
...	...	...	...	...	...	...	...	...	**155 232**
...	...	...	...	4 542 160	143 012	...	...	300[4]	1 324 514
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
792	6 236	...	...	...	...	...	...	156 191[3 5 6]	162 427
...	...	...	...	...	...	90 997	5 149 520	...	5 149 320
...	...	...	...	...	...	**88 487**	**5 292 407**	...	**5 292 407**
102 400	298 824	...	...	...	...	1 762 779	39 835 441	16 894[7]	40 151 239
751 067	3 387 949	...	...	...	...	...	...	...	5 388 986
684 924	**5 804 770**	...	...	...	...	...	...	...	**6 214 000**
8 437 334	38 959 426	...	...	...	...	...	...	1 276[8 9]	43 873 924
...	...	...	...	...	...	...	...	...	90 000
...	...	...	...	...	...	...	...	...	**240 171**
...	...	...	...	...	...	...	...	783 578[10]	2 770 107
...	...	...	...	...	...	...	...	...	2 000
...	...	...	...	...	...	...	...	...	...
1 131 179	6 323 178	...	...	192 640	2 075	...	...	203 055[5 6]	6 542 538
...	...	304 006	930 241	...	...	132 372	8 864 110	...	91 483 287
...	...	**13 849**	**33 598**	...	...	**272 716**	**19 291 184**	...	**96 095 067**
...	...	1 645 283	5 767 103	...	...	1 592 295	52 776 088	...	744 499 379
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	253 391	467 966	...	...	...	...	5 129[9]	473 095
...	...	...	...	...	...	...	...	...	81 525
...	...	...	...	...	...	...	...	...	**100 448**
...	...	...	...	...	...	...	...	...	3 140 391
...	...	...	...	...	...	...	...	...	1 567 334
...	...	...	...	...	...	...	...	...	**1 460 492**
...	...	...	...	...	...	...	...	55 901[8]	12 444 852
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	1 611 625
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
2 184	10 050	...	...	...	...	...	...	...	10 050
...	...	145 150	650 000	...	...	...	...	...	651 740
...	...	**45 359**	**100 000**	...	...	...	...	...	**109 578**
...	...	748 448	2 289 882	...	...	...	...	11 460[11 12]	2 323 893
...	...	...	...	...	...	...	...	...	33 873
...	...	...	...	...	...	...	...	...	**46 569**
...	...	...	...	720 664	25 938	...	...	306 533[5 10 11]	6 881 883
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
227	1 700	...	...	...	...	...	...	16 858[13]	18 558
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	287 689	10 815	37 761	178 678	...	1 240 215
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	623 773	6 550 969	97 389[8]	7 066 964
...	...	...	...	...	...	...	...	...	10 573
...	...	...	...	...	...	...	...	...	...
...	...	...	...	72 801	3 978	...	...	...	244 239
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	30 226[8 9]	190 811
...	...	...	...	...	...	136 044	7 698 729	3 630 167	11 328 896
...	...	...	...	...	...	**146 363**	**8 753 971**	**3 996 907**	**12 750 878**
...	...	...	...	...	...	5 926 358	92 123 035	13 459 006	105 582 041
751 067	5 387 949	449 156	1 580 241	...	...	359 413	21 712 359	3 630 167	115 926 007
684 924	**5 804 770**	**59 208**	**133 598**	...	...	**507 566**	**33 337 562**	**3 996 907**	**122 464 842**
9 674 116	45 599 414	2 647 122	8 524 951	5 815 954	185 818	9 942 966	191 464 211	15 173 519	980 582 468

[8] Iron oxide and ochre.
[9] Talc.
[10] Fluorspar.
[11] Arsenious oxide.
[12] Perlite.
[13] Bentonite.

Table 3-7E—Production of Structural Materials by Mining Divisions 1980 and 1981, and Total to Date

Division	Period	Cement	Lime and Lime-stone	Building Stone	Rubble, Riprap, and Crushed Rock	Sand and Gravel	Clay Products	Unclassified Materials	Division Total
		$	$	$	$	$	$	$	$
Alberni	1980					2 355 915			2 355 915
	1981					**1 022 903**			**1 022 903**
	To Date				346 659	11 796 824			12 143 483
Atlin	1980					83 380			83 380
	1981								
	To Date		1 108		102 453	387 008			490 569
Cariboo	1980		1 110 337		5 579 023	9 198 444			15 887 804
	1981		**646 764**		**4 021 833**	**5 856 751**			**10 525 348**
	To Date		5 908 713		23 843 745	57 948 162	332 457		88 033 077
Clinton	1980				111 790	4 008 836			4 120 626
	1981				**3 856**	**1 217 686**			**1 221 542**
	To Date				3 353 076	12 418 587			15 771 663
Fort Steele	1980				51 000	2 850 123			2 901 123
	1981				**1 753**	**1 365 555**			**1 367 308**
	To Date		43 873	71 941	3 037 064	16 811 503	15 918		19 980 299
Golden	1980					830 648			830 648
	1981					**571 867**			**571 867**
	To Date		1 000	50 840	255 923	6 231 371	128 159		6 667 293
Greenwood	1980		40 250	50		1 068 968			1 109 268
	1981		**32 288**			**470 519**			**502 807**
	To Date		140 259	161 090	278 474	5 208 878	121 283		5 909 984
Kamloops	1980	17 759 447			712 567	4 382 123			22 854 137
	1981	**22 643 289**			**4 114 265**	**2 390 027**			**29 147 581**
	To Date	100 469 258	25 067	19 800	23 441 262	32 758 485	72 379		156 786 251
Liard	1980				2 020 030	6 992 332			9 012 362
	1981				**69 072**	**5 953 636**			**6 022 708**
	To Date				4 711 910	40 812 067			45 523 977
Lillooet	1980		437 142		8 700	89 632			535 474
	1981		**442 477**		**7 409**	**549 623**			**999 509**
	To Date		2 193 625	11 755	1 138 927	3 036 876			6 381 183
Nanaimo	1980		6 859 837		1 499 861	6 921 475			15 281 173
	1981		**6 509 426**		**662 607**	**5 504 711**			**12 676 744**
	To Date		94 410 551	3 450 735	10 451 855	41 346 326	1 178 992		150 838 459
Nelson	1980		1 342 634		31 488	2 076 740			3 450 862
	1981		**1 651 584**		**3 480**	**1 222 164**			**2 877 228**
	To Date		8 007 648	437 138	627 365	13 263 649	21 974		22 357 774
New Westminster	1980		98 903		1 080 190	18 086 888	10 387 121		29 653 102
	1981		**101 569**		**916 299**	**30 332 086**	**10 292 772**		**41 642 726**
	To Date		4 002 250	20 974	28 258 952	220 719 443	141 159 237		394 160 856
Nicola	1980					532 380			532 380
	1981					**584 125**			**584 125**
	To Date			8 000	187 994	4 331 165			4 527 159
Omineca	1980		8 940		10 033 600	4 320 813			14 363 353
	1981		**2 314**		**342 532**	**1 700 188**			**2 045 034**
	To Date		54 031	701	13 917 687	24 344 819	5 274		38 322 512
Osoyoos	1980					755 390			755 390
	1981					**529 628**			**529 628**
	To Date		43 774	33 018	355 349	8 748 319			9 180 460
Revelstoke	1980			9 800	2 269 951	1 039 779			3 319 530
	1981			**16 680**	**89 010**	**1 030 039**			**1 135 729**
	To Date		1 000	103 625	3 146 514	6 336 202			9 587 341
Similkameen	1980					690 812			690 812
	1981					**19 355**			**19 355**
	To Date	10 500	11 571	24 000	712 341	6 167 823	13 355		6 939 590
Skeena	1980		16 062		9 038 256	9 093 221			18 147 539
	1981				**868 267**	**2 367 088**			**3 235 355**
	To Date		1 661 362	144 000	16 238 069	36 138 065	13 249		54 194 745
Slocan	1980					451 006			451 006
	1981					**551 366**			**551 366**
	To Date		1 000	115 143	157 323	4 229 429			4 502 895
Trail Creek	1980					1 331 588			1 331 588
	1981					**509 341**			**509 341**
	To Date		32 500	85 520	381 393	7 988 695			8 488 108
Vancouver	1980	57 446 234				8 092 124			65 538 358
	1981	**58 167 660**				**9 443 639**			**67 611 299**
	To Date	308 618 504	40 885	4 012 560	8 681 796	107 258 700	1 088 592		429 701 037
Vernon	1980					4 603 676			4 603 676
	1981					**2 984 517**			**2 984 517**
	To Date		351 416	141 367	403 649	28 343 883	161 254		29 401 569
Victoria	1980	15 675 405	30 939			8 809 807			24 516 151
	1981	**1 561 426**	**13 783**			**11 289 278**			**12 864 487**
	To Date	326 058 081	1 229 431	55	532 563	85 281 727	10 855 136		423 956 993
Not Assigned	1980								
	1981					**137 772**			**137 772**
	To Date		315 498	505 018	2 879 844	66 223 520	3 180 828	5 972 171	79 076 879
Totals	1980	90 881 086	9 945 044	9 850	32 436 456	98 666 100	10 387 121		242 325 657
	1981	**82 372 375**	**9 400 205**	**16 680**	**11 100 383**	**87 603 864**	**10 292 772**		**200 786 279**
	To Date	735 156 343	118 476 562	9 397 280	147 442 187	848 131 526	158 348 087	5 972 171	2 022 924 156

Table 3-8A—Production of Coal, 1836–1981

Year	Quantity[1]	Value	Year	Quantity[1]	Value
	t	$		t	$
1836–59	37 985	149 548	1921	2 422 455	12 836 013
1860	14 475	56 988	1922	2 473 692	12 880 060
1861	13 995	55 096	1923	2 391 998	12 678 548
1862	18 409	72 472	1924	1 839 619	9 911 935
1863	21 687	85 380	1925	2 305 337	12 168 905
1864	29 091	115 528	1926	2 182 760	11 650 180
1865	33 345	131 276	1927	2 316 408	12 269 135
1866	25 518	100 460	1928	2 431 794	12 633 510
1867	31 740	124 956	1929	2 154 607	11 256 260
1868	44 711	176 020	1930	1 809 364	9 435 650
1869	36 376	143 208	1931	1 601 600	7 684 155
1870	30 322	119 372	1932	1 464 759	6 523 644
1871	50 310	164 612	1933	1 249 347	5 375 171
1882	50 310	164 612	1934	1 297 306	5 725 133
1873	50 311	164 612	1935	1 159 721	5 048 864
1874	82 856	244 641	1936	1 226 780	5 722 502
1875	111 912	330 435	1937	1 312 003	6 139 920
1876	141 425	417 576	1938	1 259 626	5 565 069
1877	156 525	462 156	1939	1 416 184	6 280 956
1878	173 587	522 538	1940	1 507 758	7 088 265
1879	245 172	723 903	1941	1 673 516	7 660 000
1880	271 889	802 785	1942	1 810 731	8 237 172
1881	232 020	685 171	1943	1 682 591	7 742 030
1882	286 666	846 417	1944	1 752 626	8 217 966
1883	216 721	639 897	1945	1 381 654	6 454 360
1884	400 391	1 182 210	1946	1 305 516	6 732 470
1885	371 461	1 096 788	1947	1 538 895	8 680 440
1886	331 875	979 908	1948	1 455 552	9 765 395
1887	419 992	1 240 080	1949	1 470 782	10 549 924
1888	497 150	1 467 903	1950	1 427 907	10 119 303
1889	589 133	1 739 490	1951	1 427 513	10 169 617
1890	689 020	2 034 420	1952	1 272 150	9 729 739
1891	1 045 607	3 087 291	1953	1 255 662	9 528 279
1892	839 591	2 479 005	1954	1 186 849	9 154 544
1893	993 988	2 934 882	1955	1 209 157	8 986 501
1894	1 029 204	3 038 859	1956	1 285 664	9 346 518
1895	954 727	2 824 687	1957	984 886	7 340 339
1896	909 237	2 693 961	1958	722 490	5 937 860
1897	906 610	2 734 522	1959	625 964	5 472 064
1898	1 146 015	3 582 595	1960	715 455	5 242 223
1899	1 302 088	4 126 803	1961	833 827	6 802 134
1900	1 615 688	4 744 530	1962	748 731	6 133 986
1901	1 718 692	5 016 398	1963	771 594	6 237 997
1902	1 667 960	4 832 257	1964	826 737	6 327 678
1903	1 473 933	4 332 297	1965	862 513	6 713 590
1904	1 712 739	4 953 024	1966	771 848	6 196 219
1905	1 855 121	5 511 861	1967	824 436	6 045 341
1906	1 929 540	5 548 044	1968	870 180	7 588 989
1907	2 255 214	7 637 713	1969	773 226	6 817 155
1908	2 143 225	7 356 866	1970	2 398 635	19 559 669
1909	2 439 109	8 574 884	1971	4 141 496	45 801 936
1910	3 007 074	11 108 335	1972	5 466 846	66 030 210
1911	2 305 778	8 071 747	1973	6 924 733	87 976 105
1912	2 913 778	10 786 812	1974	7 757 440	154 593 643
1913	2 461 665	9 197 460	1975	8 924 816	317 111 744
1914	2 029 400	7 745 847	1976	7 537 695	298 683 679
1915	1 883 851	7 114 178	1977	8 424 181	328 846 883
1916	2 343 671	8 900 675	1978	9 463 920	381 895 241
1917	2 209 982	8 484 343	1979	10 570 370	439 280 152
1918	2 336 238	12 833 994	1980	10 823 530	461 492 857
1919	2 207 659	11 975 671	1981	11 752 621	554 271 292
1920	2 587 763	13 450 169	Totals	223 409 580	3 772 267 287

[1] Quantity from 1836 to 1909 is gross mine output and includes material lost in picking and washing. For 1910 and subsequent years the quantity is that sold and used.

Table 3-8B—Coal Production and Distribution

	Raw Coal Production			Clean Coal Production	Coal Used
	Surface	Underground	Total		Making Coke and Plant Use
Fort Steele Mining Division	t	t	t	t	t
B.C. Coal					
Metallurgical	7 653 186	994 410	8 647 596	7 101 360	261 068
Thermal	403 669		403 669	403 675	
Byron Creek Collieries Ltd.					
Thermal	526 715		526 715	441 237	
Fording Coal Ltd.					
Metallurgical	5 825 076		5 825 076	3 721 184	
Total Fort Steele	14 408 646	994 410	15 403 056	11 667 456	261 068
Liard Mining Division					
B.P. Canada Inc.*					
Metallurgical	75 070		75 070	75 070	
Omineca Mining Division					
Bulkley Valley Coal Ltd.					
Thermal	11 494		11 494		9
Totals 1981					
Metallurgical	13 553 332	994 410	14 547 742	10 897 614	261 068
Per cent of 1981 totals	96	100	94	93	100
Thermal	941 878		941 878	844 912	9
Per cent of 1981 totals	4		6	7	
Totals 1981	14 495 210	994 410	15 489 620	11 742 526	261 077

* Estimated test shipments.

Table 3-8C—Raw and Clean Coal Produced

Year	Raw Coal Produced			Clean Coal Produced		
	Metallurgical	Thermal	Total	Metallurgical	Thermal	Total
	t	t	t	t	t	t
1973	9 806 384	77 287	9 883 671	6 992 044	58 866	7 050 910
1974	9 503 578	658 697	10 162 275	7 133 053	607 337	7 740 390
1975	12 160 856	777 937	12 938 793	8 872 438	766 733	9 579 802
1976	9 405 065	724 935	10 130 000	6 785 282	713 087	7 498 369
1977	10 564 568	993 022	11 557 590	7 793 920	786 729	8 580 649
1978	11 093 352	1 285 863	12 379 215	8 034 021	1 059 027	9 093 048
1979	13 412 935	1 214 796	14 627 731	9 676 908	906 742	10 583 650
1980	12 901 844	1 261 669	14 163 513	9 098 175	1 058 050	10 156 225
1981	14 547 742	941 878	15 489 620	10 897 614	844 912	11 742 526

by Collieries and by Mining Division, 1981

Coal Sales							Total Coal Sold and Used		
Canada			United States	Japan	Others	Total	Quantity	Total Value	Average Value
British Columbia	Other Provinces	Total							
t	t	t	t	t	t	t	t	$	$/t
11	...	11	22 035	4 319 369	2 436 148	6 777 563	7 038 631	344 030 292	48.88
2 514	439	2 953	26 579	25 233	428 939	483 704	483 704	22 226 007	45.95
20 186	295 993	316 179	18 902	110 844		445 925	445 925	13 557 088	30.40
35 023	...	35 023	...	2 999 456	663 318	3 697 797	3 697 797	173 398 942	46.89
57 734	296 432	354 166	67 516	7 454 902	3 528 405	11 404 989	11 666 057	553 212 329	47.42
...	...	...	...	38 244	36 826	75 070	75 070	998 350	13.30
3 948	7 537	11 485	...	...	...	11 485	11 494	60 613	5.27
35 034	...	35 034	22 035	7 357 069	3 136 292	10 550 430	10 811 498	518 427 584	47.95
57	...	10	33	98	88	92	92	94	...
26 648	303 969	330 617	45 481	136 077	428 939	941 114	941 123	35 843 708	38.09
43	100	90	67	2	12	8	8	6	...
61 682	303 969	365 651	67 516	7 493 146	3 565 231	11 491 544	11 752 621	554 271 292	47.16

and Coal Sold and Used, 1973–1981

Coal Sold and Used								
Metallurgical			Thermal			Totals		
Quantity	Value	Average Price Per t	Quantity	Value	Average Price Per t	Quantity	Value	Average Price Per t all Types of Coal
t	$	$	t	$	$	t	$	$
6 853 120	87 406 677	12.75	71 613	569 428	7.21	6 924 733	87 976 105	12.70
7 261 404	149 025 665	20.52	496 036	5 567 978	11.22	7 757 440	154 593 643	19.93
8 104 102	305 484 901	37.70	820 714	11 626 843	14.17	8 924 816	317 111 744	35.53
6 824 493	283 753 979	41.58	713 202	14 929 700	20.93	7 537 695	298 683 679	39.63
7 615 953	314 316 005	41.27	808 228	14 639 667	18.11	8 424 181	328 846 883	39.04
8 530 370	361 254 854	42.35	933 550	20 640 387	22.11	9 463 920	381 895 241	40.35
9 591 975	412 392 598	42.99	978 395	26 887 554	27.48	10 570 370	439 280 152	41.56
9 654 317	423 128 068	43.83	1 169 213	38 364 789	32.81	10 823 530	461 492 857	42.64
10 811 498	518 427 584	47.95	914 123	35 843 708	38.09	11 752 621	554 271 292	47.16

Table 3-8D—Destination of B.C. Coal—1981*

Destination	B.C. Coal		B.P. Canada Inc.	Byron Creek	Fording Coal	Bulkley Valley	Total Sales		Grand Totals
	Metallurgical	Thermal	Metallurgical†	Thermal	Metallurgical	Thermal	Metallurgical	Thermal	
	t	t	t	t	t	t	t	t	t
Canada—									
B.C.	11	2 514	.....	20 186	35 023	3 948	35 034	26 648	61 682
Alberta	.....	439	.....	476				915	915
Manitoba	.....	.....	.....	27 641		7 537	.....	35 178	35 178
Ontario	.....	.....	.....	267 876	.....		.....	267 876	267 876
Totals	11	2 953	.....	316 179	35 023	11 485	35 034	330 617	365 651
Foreign—									
Belgium	.....	55 813	.....	.....				55 813	55 813
Brazil	337 249	.....	.....	.....	92 550		429 799	.....	429 799
Chile	108 299	.....	.....	.....	139 548		247 847	.....	247 847
Denmark	.....	319 249	.....	.....				319 249	319 249
Japan	4 319 369	25 233	38 244	110 844	2 999 456		7 357 069	136 077	7 493 146
Korea	1 433 981	.....	36 826	.....	225 212		1 696 019		1 696 019
Mexico	219 198	.....	.....	.....			219 198		219 198
Pakistan	105 284	.....	.....	.....			105 284		105 284
Spain	.....	53 877	.....	.....				53 877	53 877
Sweden	163 659	.....	.....	.....			163 659		163 659
Taiwan	68 478	.....	.....	.....	206 008		274 486		274 486
U.S.A.	22 035	26 579	.....	18 902			22 035	45 481	67 516
Totals	6 777 552	480 751	75 070	129 746	3 662 774	.....	10 515 396	610 497	11 125 893
Totals, all sales	6 777 563	483 704	75 070	445 925	3 697 797	11 485	10 550 430	941 114	11 491 544

* Excludes coal used at plants and for making coke.
† Estimated test shipments.

Table 3-9—Principal Items of Expenditures for Operations of all Classes

Class	Salaries and Wages	Fuel and Electricity	Process Supplies
	$	$	$
Metal Mining	281 251 126	105 951 083	307 931 017
Exploration and Development	238 231 757		
Coal	106 304 659	34 390 886	26 056 644
Petroleum and Natural Gas (Exploration and Development)	8 192 125		
Industrial Minerals	19 514 015	8 236 633	4 396 643
Structural Materials Industry	19 632 231	1 474 714	8 285 624
Totals, 1981	673 125 913	150 053 316	346 669 928
1980	449 970 343	110 011 602	267 065 783
1979	387 135 371	97 166 988	211 066 592
1978	335 136 110	84 785 125	189 133 090
1977	337 382 149	71 149 313	192 025 357
1976	277 736 828	59 220 204	170 075 616
1975	246 953 568	49 104 838	154 476 238
1974	272 945 078	42 381 258	140 002 685
1973	221 877 595	36 750 711	103 840 649
1972	199 351 449	31 115 621	77 092 955
1971	179 175 692	23 166 904	68 314 944
1970	172 958 282	19 116 672	59 846 370
1969	123 450 327	14 554 123	43 089 559
1968	113 459 219	13 818 326	38 760 203
1967	94 523 495	13 590 759	34 368 856
1966	93 409 528	12 283 477	28 120 179
1965	74 938 736	11 504 343	30 590 631
1964	63 624 559	10 205 861	27 629 953
1963	57 939 294	10 546 806	12 923 325
1962	55 522 171	9 505 559	14 024 799
1961	50 887 275	8 907 034	17 787 127
1960	52 694 818	7 834 728	21 496 912
1959	49 961 996	7 677 321	17 371 638
1958	48 933 560	8 080 989	15 053 036
1957	56 409 056	8 937 567	24 257 177
1956	57 266 026	9 762 777	22 036 839
1955	51 890 246	9 144 034	21 131 572
1954	48 702 746	7 128 669	19 654 724
1953	55 543 490	8 668 099	20 979 411
1952	62 256 631	8 557 845	27 024 500
1951	52 607 171	7 283 051	24 724 101
1950	42 738 035	6 775 998	17 500 663
1949	41 023 786	7 206 637	17 884 408
1948	38 813 506	6 139 470	14 532 121
1947	32 160 338	5 319 470	13 068 948
1946	26 190 200	5 427 458	8 367 705
1945	22 620 975	7 239 726	5 756 628
1944	23 131 874	5 788 671	6 138 084
1943	26 051 467	7 432 585	6 572 317
1942	26 913 160	7 066 109	6 863 398
1941	26 050 491	3 776 747	7 260 441
1940	23 391 330	3 474 721	6 962 162
1939	22 357 035	3 266 000	6 714 347
1938	22 765 711	3 396 106	6 544 500
1937	21 349 690	3 066 311	6 845 330
1936	17 887 619	2 724 144	4 434 501
1935	16 753 367	2 619 639	4 552 730

NOTE—This table has changed somewhat through the years, so that the items are not everywhere directly comparable. Prior to 1962, lode mining referred only to gold, silver, copper, lead, and zinc. Prior to 1964, some expenditures for fuel and electricity were included with process supplies. Process supplies (except fuel) were broadened in 1964 to include "process, operating maintenance and repair supplies . . . used in the mine/mill operations; that is explosives, chemicals, drill steel, bits, lubricants, electrical, etc . . . not charged to Fixed Assets Account . . . provisions and supplies sold in any company-operated cafeteria or commissary." Exploration and development other than in the field of petroleum and natural gas is given, starting in 1966.

Table 3-10—Employment in the Mineral Industry, 1901–1981

Year	Placer	Metals					Coal Mines			Structural Materials		Industrial Materials	Exploration and Development	Petroleum and Natural Gas Exploration and Development	Total
		Mines		Concentrators	Smelters	Total	Under	Above[1]	Total	Quarries and Pits	Plants				
		Under	Above												
1901	....	2 736	1 212	....	....	3 948	3 041	933	3 974	....	....	....	....	....	7 922
1902	....	2 219	1 126	....	....	3 345	3 101	910	4 011	....	....	....	....	....	7 356
1903	....	1 662	1 088	....	....	2 750	3 137	1 127	4 264	....	....	....	....	....	7 014
1904	....	2 143	1 163	....	....	3 306	3 278	1 175	4 453	....	....	....	....	....	7 759
1905	....	2 470	1 240	....	....	3 710	3 127	1 280	4 407	....	....	....	....	....	8 117
1906	....	2 680	1 303	....	....	3 983	3 415	1 390	4 805	....	....	....	....	....	8 788
1907	....	2 704	1 239	....	....	3 943	2 862	907	3 769	....	....	....	....	....	7 712
1908	....	2 567	1 127	....	....	3 694	4 432	1 641	6 073	....	....	....	....	....	9 767
1909	....	2 184	1 070	....	....	3 254	4 713	1 705	6 418	....	....	....	....	....	9 672
1910	....	2 472	1 237	....	....	3 709	5 903	1 855	7 758	....	....	....	....	....	11 467
1911	....	2 435	1 159	....	....	3 594	5 212	1 661	6 873	....	....	....	....	....	10 467
1912	....	2 472	1 364	....	....	3 836	5 275	1 855	7 130	....	....	....	....	....	10 966
1913	....	2 773	1 505	....	....	4 278	4 950	1 721	6 671	....	....	....	....	....	10 949
1914	....	2 741	1 433	....	....	4 174	4 267	1 465	5 732	....	....	....	....	....	9 906
1915	....	2 709	1 435	....	....	4 144	3 708	1 283	4 991	....	....	....	....	....	9 135
1916	....	3 357	2 036	....	....	5 393	3 694	1 366	5 060	....	....	....	....	....	10 453
1917	....	3 290	2 198	....	....	5 488	3 760	1 410	5 170	....	....	....	....	....	10 658
1918	....	2 626	1 764	....	....	4 390	3 658	1 769	5 427	....	....	....	....	....	9 817
1919	....	2 513	1 746	....	....	4 259	4 145	1 821	5 966	....	....	....	....	....	10 225
1920	....	2 074	1 605	....	....	3 679	4 191	2 158	6 349	....	....	....	....	....	10 028
1921	....	1 355	975	....	....	2 330	4 722	2 163	6 885	....	....	....	....	....	9 215
1922	....	1 510	1 239	....	....	2 749	4 712	1 932	6 644	....	....	....	....	....	9 393
1923	....	2 102	1 516	....	....	3 618	4 342	1 807	6 149	....	....	....	....	....	9 767
1924	....	2 353	1 680	....	....	4 033	3 894	1 524	5 418	....	....	....	....	....	9 451
1925	....	2 298	2 840	....	....	5 138	3 828	1 615	5 443	....	....	....	....	....	10 581
1926	299	2 606	1 735	808	2 461	7 610	3 757	1 565	5 322	493	324	124	....	....	14 172
1927	415	2 671	1 916	854	2 842	8 283	3 646	1 579	5 225	647	138	122	....	....	14 830
1928	355	2 707	2 469	911	2 748	8 835	3 814	1 520	5 334	412	368	120	....	....	15 424
1929	341	2 926	2 052	966	2 948	8 892	3 675	1 353	5 028	492	544	268	....	....	15 565
1930	425	2 316	1 260	832	3 197	7 605	3 389	1 256	4 645	843	344	170	....	....	14 032
1931	688	1 463	834	581	3 157	6 035	2 957	1 125	4 082	460	526	380	....	....	12 171
1932	874	1 355	900	542	2 036	4 833	2 628	980	3 608	536	329	344	....	....	10 524
1933	1 134	1 786	1 335	531	2 436	6 088	2 241	853	3 094	376	269	408	....	....	11 369
1934	1 122	2 796	1 729	631	2 890	8 046	2 050	843	2 893	377	187	360	....	....	12 985
1935	1 291	2 740	1 497	907	2 771	7 915	2 145	826	2 971	536	270	754	....	....	13 737
1936	1 124	2 959	1 840	720	2 678	8 197	2 015	799	2 814	931	288	825	....	....	14 179
1937	1 371	3 603	1 818	1 168	3 027	9 616	2 286	867	3 153	724	327	938	....	....	16 129
1938	1 303	3 849	2 266	919	3 158	10 192	2 088	874	2 962	900	295	369	....	....	16 021
1939	1 252	3 905	2 050	996	3 187	10 138	2 167	809	2 976	652	311	561	....	....	15 890
1940	1 004	3 923	2 104	1 048	2 944	10 019	2 175	699	2 874	827	334	647	....	....	15 705
1941	939	3 901	1 823	1 025	3 072	9 821	2 229	494	2 723	766	413	422	....	....	15 084
1942	489	2 920	1 504	960	3 555	8 939	1 892	468	2 360	842	378	262	....	....	13 270
1943	212	2 394	1 699	891	2 835	7 819	2 240	611	2 851	673	326	567	....	....	12 448
1944	255	1 896	1 825	849	2 981	7 551	2 150	689	2 839	680	351	628	....	....	12 314
1945	209	1 933	1 750	822	2 834	7 339	1 927	503	2 430	921	335	586	....	....	11 820
1946	347	1 918	1 817	672	2 813	7 220	1 773	532	2 305	827	555	679	....	....	11 933
1947	360	3 024	2 238	960	3 461	9 683	1 694	731	2 425	977	585	869	....	....	14 899
1948	348	3 143	2 429	1 126	3 884	10 582	1 594	872	2 466	1 591	656	754	....	....	16 397
1949	303	3 034	2 724	1 203	3 763	10 724	1 761	545	2 306	2 120	542	626	....	....	16 621
1950	327	3 399	2 415	1 259	3 759	10 832	1 745	516	2 261	1 916	616	660	....	....	16 612
1951	205	3 785	3 695	1 307	4 044	12 831	1 462	463	1 925	1 783	628	491	....	....	17 863
1952	230	4 171	3 923	1 516	4 120	13 730	1 280	401	1 681	1 530	557	529	....	....	18 257
1953	132	3 145	2 589	1 371	3 901	11 006	1 154	396	1 550	1 909	559	634	....	....	15 790
1954	199	2 644	2 520	1 129	3 119	9 412	1 076	358	1 434	1 861	638	584	....	....	14 128
1955	103	2 564	2 553	1 091	3 304	9 512	1 100	378	1 478	1 646	641	722	....	....	14 102
1956	105	2 637	2 827	1 043	3 339	9 846	968	398	1 366	1 598	770	854	....	....	14 539
1957	67	2 393	2 447	838	3 328	9 006	1 020	360	1 380	1 705	625	474	....	....	13 257
1958	75	1 919	1 809	625	3 081	7 434	826	260	1 086	1 483	677	446	....	....	11 201
1959	99	1 937	1 761	618	3 008	7 324	765	291	1 056	1 357	484	459	....	....	10 779
1960	86	1 782	1 959	648	3 034	7 423	894	288	1 182	1 704	557	589	....	....	11 541
1961	74	1 785	1 582	626	3 118	7 111	705	237	942	1 828	508	571	....	....	11 034
1962	35	1 677	1 976	949	3 356	7 958	548	228	776	1 523	481	517	270	....	11 560
1963	43	1 713	2 012	850	3 239	7 814	501	247	748	909	460	528	450	....	10 952
1964	5	1 839	1 967	822	3 281	7 909	446	267	713	1 293	444	509	772	....	11 645
1965	2	1 752	2 019	965	3 529	8 265	405	244	649	1 079	422	639	786	441	12 283
1966	2	2 006	2 296	1 014	3 654	8 970	347	267	614	1 269	393	582	1 894	478	14 202
1967	....	1 928	2 532	992	3 435	8 887	260	197	457	1 309	372	584	1 264	507	13 380
1968	....	1 823	2 369	1 072	3 283	8 547	195	358	553	1 207	380	582	3 990	400	15 659
1969	7	1 794	2 470	1 099	3 468	8 831	245	455	700	1 097	549	567	4 270	416	16 437
1970	....	2 160	3 167	1 331	3 738	10 396	242	1 033	1 275	740	647	627	4 964	437	19 086
1971	....	2 073	3 058	1 513	3 481	10 125	444	1 013	1 457	846	794	666	4 040	495	18 423
1972	....	1 833	3 463	1 734	3 353	10 383	214	1 771	1 985	1 116	800	527	4 201	458	19 470
1973	....	1 704	4 005	2 394	3 390	11 493	265	1 951	2 216	898	802	667	3 392	454	19 922
1974	....	1 509	4 239	2 352	2 767	10 867	267	2 255	2 522	895	782	646	2 848	509	19 069
1975	....	1 100	3 619	1 983	3 733	10 435	299	2 464	2 763	826	725	705	2 931	518	18 903
1976	....	1 268	3 733	2 048	3 542	10 591	327	2 300	2 627	931	680	670	3 101	495	19 095
1977	....	1 208	3 768	2 224	3 590	10 790	312	2 556	2 868	1 380	626	766	3 537	490	20 457
1978	....	1 009	3 874	2 029	3 838	10 750	377	2 606	2 983	734	460	618	3 232	496	19 273
1979	....	898	3 615	2 084	4 273	10 870	413	2 931	3 344	931	601	726	3 707	489	20 668
1980	....	1 012	4 173	2 463	4 800	12 448	354	3 258	3 612	473	940	728	5 800	362	24 363
1981	....	**1 280**	**5 292**	**2 986**	**4 843**	**14 401**	**343**	**3 277**	**3 620**	**131**	**562**	**678**	**7 201**	**298**	**26 891**

[1] Commencing with 1967, does not include employment in by-product plants.

NOTE.—These figures refer only to company employees and do not include the many employees of contracting firms.

Table 3-11—Employment at Major Metal and Coal Mines, 1981

	Tonnes		Days Operating Mill	Average Number Employed[1]					
				Administrative, Etc.	Mine		Mill	Others	Total
	Mined	Milled			Surface	Underground			
Metal Mines									
Afton Mines Ltd. (Afton)	2 543 648	2 324 119	318	45	191		92		328
Amax of Canada Ltd. (Kitsault)	1 840 717	1 840 717	239	157	195		58	22	432
Bethlehem Copper Corp. (Bethlehem)	7 174 464	6 496 250	365	47	188		139		374
Brenda Mines Ltd. (Brenda)	10 432 200	10 199 317	363	124	170		168	18	480
Canada Wide Mines Ltd. (Granduc)	614 206	613 936	365	52		216	176		444
Cominco Ltd. (Sullivan)	2 051 720	2 209 667	351	213	132	497	216		1 058
Craigmont Mines Ltd. (Craigmont)	1 460 415	1 450 995	362	44	78	45	32	4	203
Dankoe Mines Ltd. (Horn Silver)	21 468	21 468	145	8		18	7		33
David Minerals Ltd. (Utica)	14 515	14 515	200	1	2		12		15
Dekalb Mining Corp. (Highland Valley)	107 129	107 129	243	18	31	45	23		117
Dickenson Mines Ltd. (Silvana)	23 723	27 671	347	5	17	36	16		74
Dupont of Canada Exploration Ltd. (Baker)	17 545	17 545	236	11		9	21	1	42
Equity Silver Mines Ltd. (Equity Silver)	2 023 087	1 909 871	365	110	60		88		258
Erickson Gold Mining Corp.	38 243	38 243	342	7	16	21	12	17	73
Falconbridge Nickel Mines Ltd. (Tasu)	1 031 909	1 031 909	314	53		36	84		173
Gibraltar Mines Ltd. (Gibraltar)	12 913 700	13 257 620	361	146	159		340		645
Highmont Operating Corp. (Highmont)	9 059 365	6 397 689	363	52	137		82	163	434
Lornex Mining Corp. Ltd. (Lornex)	21 099 986	20 739 392	365	112	585		329	10	1 036
Mosquito Creek Gold Mining Co. (Aurum)	21 800	21 121	240	13		21	17	5	56
Newmont Mines Ltd. (Similkameen)	7 078 944	6 868 587	365	83	161		104		348
Noranda Mines Ltd. (Bell)	5 520 508	5 429 531	365	93	78		198		369
Noranda Mines Ltd. (Boss Mountain)	468 000	468 000	365	51	7	58	78		194
Noranda Mines Ltd. (Granisle)	3 217 860	3 832 538	365	76	114		74	56	320
Northair Mines Ltd. (Warman)	58 490	62 452	250	19		56	17	14	106
Placer Development Ltd. (Endako)	11 500 000	10 492 000	360	137	136		362		635
Ruth Vermont Mines Ltd. (Ruth Vermont)	12 839	12 839	105	6		14	5	9	34
Scottie Gold Mine Ltd. (Scottie)	6 646	6 646	92	5		5	8		18
Teck Corp. Ltd. (Highland Bell)	35 807	35 801	355	8		20	10	6	44
Trident	1 457	1 457	97	1		4	3	3	11
Utah Mines Ltd. (Island Copper)	14 086 889	14 156 617	364	144	557		197		898
Wesmin Resources Ltd. (Lynx and Myra)	246 150	246 150	293	55		179	18	54	306
Total Metal Mines				1 896	3 014	1 280	2 986	382	9 558
Coal Mines	Raw Coal								
B.C. Coal Ltd.	9 051 264		365	518	1 012	343	203		2 076
Byron Creek Collieries Ltd.	526 715		151	37	21		5		63
Fording Coal Ltd.	5 825 076		365	311	533		637		1 481
Total Coal Mines				866	1 566	343	845		3 620

[1] The average number of employed includes wage-earners and salaried employees. The average is obtained by adding the monthly figures and dividing by 12, irrespective of the number of months worked.

Table 3-12—Metal Production, 1981

Property or Mine (and Location of Mine)	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Content					
				Gold	Silver	Copper	Lead	Zinc	Cadmium
Alberni Mining Division		t		g	g	kg	kg	kg	kg
Lynx and Myra (Buttle Lake)	Westmin Resources Ltd.	246 150	Lead concentrates 5 354 t; zinc concentrates 27 602 t; copper concentrates 7 970 t.	572 366	26 940 813	2 402 823	2 286 971	15 863 753	63 984
Atlin Mining Division									
Atlin-Ruffner (Atlin)	Trident Resources Inc.	1 082	Lead concentrates, 33 t; zinc concentrates, 6 t.	250	26 405	443	15 832	5 869	15
Cariboo Mining Division									
Boss Mountain (Takomkane Mountain)	Noranda Mines Ltd. (Boss Mountain Div.)	468 000	Molybdenite concentrates, 1 655 t containing 906 000 kg of molybdenum.	....	....	....	....	....	....
Gibraltar (McLeese Lake)	Gibraltar Mines Ltd.	13 257 620	Copper concentrates 166 600 t; molybdic oxide, 890 t, containing 487 361 kg of molybdenum.	....	5 624 599	44 231 267	....	....	....
Mosquito Creek (Wells)	Mosquito Creek Gold Mining Co. Ltd.	21 121	Gold bullion	247 177	64 660 940	....	....	....	....
Clinton Mining Division									
Nil	....	....	....	....	....	....	....	....	....
Fort Steele Mining Division									
Sullivan (Kimberley)	Cominco Ltd.	2 209 667	Lead concentrates, 130 613 t; zinc concentrates 119 696 t; tin concentrates 361 t containing 124 213 kg of tin.	....	116 505 665	....	86 733 470	65 309 242	....
Golden Mining Division									
Ruth Vermont (Spillimacheen)	Ruth Vermont Mines Ltd.	12 839	Lead concentrates, 499 t; zinc concentrates, 417 t.	1	1 720 000	6 521	297 874	203 214	1 359
Greenwood Mining Division									
Highland Bell (Beaverdell)	Teck Corporation	35 801	Lead concentrates 471 t; zinc concentrates 409 t; jig concentrates 200 t.	10 762	12 100 372	319	157 293	182 044	1 026
Skomac (Boundary Falls) (Greenwood)	Robert Mines Ltd.	11	Crude ore	63	6 018	....	....	5 554	....
Kamloops Mining Division									
Afton (Kamloops)	Afton Mines Ltd.	2 324 119	Blister copper, 16 421 t.	1 089 617	6 459 290	16 247 062	....	....	....
Bethlehem (Highland Valley)	Bethlehem Copper Corp.	6 496 250	Copper concentrates 50 576 t; molybdenite concentrates 413 t containing 275 049 kg of molybdenum.	54 151	3 662 092	16 264 628	....	....	....
Highmont (Highland Valley)	Highmont Mining Corp.	6 397 689	Copper concentrates, 24 447 t; molybdenite concentrates, 1 839 t containing 1 161 600 kg of molybdenum.	....	....	7 636 480	....	....	....
Lornex (Highland Valley)	Lornex Mining Corp. Ltd.	20 739 392	Copper concentrates, 215 947 t; molybdenite concentrates, 1 637 t; molybdic oxide, 4 521 t; ferro-molybdenum, 201 t containing 1 732 772 kg of molybdenum.	....	17 921 014	66 180 006	....	....	....
OK. Alwin (Highland Valley)	Dekalb Mining Corp.	107 129	Copper concentrates, 5 629 t.	35 432	1 773 333	2 082 134	....	....	....

Liard Mining Division									
Erickson (McDame Lake)	Erickson Gold Mining Corp.	38 243	Gold concentrates 907 t	534 949	...	...	...	...	...
Lillooet Mining Division									
Pioneer (Bridge River)	Nelson Machinery Co. Ltd.	Clean-up	Gold concentrates	12 434	2 332	...	59	139	...
White and Bell (Gold Bridge)	J. M. Stewart, North Vancouver	4	Crude ore	217	2 116	...	336	31	...
Nanaimo Mining Division									
Island Copper (Rupert Inlet)	Utah Mines Ltd.	14 156 617	Copper concentrates 232 652 t; molybdenite concentrates 3 091 t containing 1 266 788 kg of molybdenum	1 658 562	13 113 910	53 075 826	...	...	...
Nelson Mining Division									
Bayonne (Salmo)	Goldrich Resources	39	Crude ore	200	1 611	...	156	78	...
Keystone (Silver Key) (Salmo)	R. J. Tjader, Montrose	85	Crude ore	1 370	7 709	...	1 257	551	...
Motherlode (Sheep Creek)	Nugget Mines Ltd.	30	Crude ore	1 477	936	...	61	30	...
Nugget (Sheep Creek)	Nugget Mines Ltd.	249	Crude ore	3 558	3 288	...	449	249	...
Starlight (Nelson)	R. Palmer and B. Hardwicke, Nelson	10	Crude ore	210	1 039	200	...	...	...
New Westminster Mining Division									
Nil	...	...	...	...	...	...	...	...	...
Nicola Mining Division									
Craigmont (Merritt)	Craigmont Mines Ltd.	1 450 995	Copper concentrates 34 088 t; iron concentrates 40 778 t.	−13 312[2]	...	9 545 277	...	...	...
Omineca Mining Division									
Baker (Chappelle) (Black Lake)	DuPont of Canada Exploration Ltd.	17 545	Dore bars	306 525	4 883 930	...	...	...	...
Bell (Newman) (Babine Lake)	Noranda Mines Ltd. (Babine Div.–Bell Mine)	5 429 531	Copper concentrates 85 243 t	1 010 459	2 835 020	22 648 730	...	...	...
Endako (Endako)	Placer Development Ltd. (Endako Mines Div.)	10 492 000	Molybdenum concentrates 487 t; molybdic oxide 5 009 t; ferro-molybdenum 221 t; containing 3 420 413 kg of molybdenum.	...	...	...	...	...	...
Equity Silver (Houston)	Equity Silver Mines Ltd.	1 909 871	Copper-silver-gold concentrates, 26 508 t.	512 274	175 628 426	4 285 854	...	...	...
Free Gold (Dome Mountain)	Reako Explorations Ltd.	544	Lead concentrates, 21 t	3 085	4 254	...	434	...	...
Granisle (Babine Lake)	Noranda Mines Ltd. (Babine Div.-Granisle Mine)	3 832 538	Copper concentrates 38 471 t, molybdenum concentrates, 13 t containing 6 582 kg of molybdenum.	284 534	3 249 878	11 763 221	...	...	...
Lucky Gold (Smithers)	Kryco Mines	53	Crude ore	1 008	2 356	...	211	792	...
Robin (Smithers)	W. F. McIntosh, Telkwa	22	Crude ore	156	111 753	280	6 480	2 584	...
Silverton (Hazelton)	E. Braun, Smithers	143	Crude ore	415	250 655	...	9 168	13 066	...
Silver Standard (Hazelton)	P. Kindrat, Smithers	424	Crude ore	1 010	853 940	...	26 896	26 965	...

Table 3-12—Metal Production, 1981—Continued

Property or Mine (and Location of Mine)	Owner or Agent	Ore Shipped or Treated	Product Shipped	Gross Metal Content					
				Gold	Silver	Copper	Lead	Zinc	Cad-mium
Osoyoos Mining Division		t		g	g	kg	kg	kg	kg
Brenda (Brenda Lake)	Brenda Mines Ltd.	10 199 317	Copper concentrates 38 160 t; molybdenite concentrates 5 605 t containing 3 134 312 kg of molybdenum	102 452	5 877 521	11 225 206	...	...	...
Horn Silver (Keremeos)	Dankoe Mines Ltd.	21 468	Bulk concentrates 710 t	7 460	2 651 520	...	4 694	6 882	...
Revelstoke Mining Division									
Nil	...	...	...	...	...	...	...	...	...
Similkameen Mining Division									
Similkameen (Ingerbelle) (Princeton)	Newmont Mines Ltd. (Similkameen Div.)	6 868 587	Copper concentrates 80 707 t	837 648	4 527 422	23 146 864	...	...	...
Skeena Mining Division									
Goat Ridge (Stewart)	Nor-Quest Resources Ltd.	415	Silver concentrates 20 t; crude ore 395 t	953	292 648	...	...	10 103	...
Granduc (Stewart)	Canada Wide Mines Ltd.	613 936	Copper concentrates, 26 969 t	75 283	4 850 000	7 626 025	...	...	...
Kitsault (Alice Arm)	Amax of Canada Ltd.	1 [illegible]0 717	Molybdenite concentrates, 1 738 t containing 548 929 kg of molybdenum	...	...	...	...	...	...
Scottie (Summit Lake) (Stewart)	Scottie Gold Mines Ltd.	6 646	Gold concentrates	90 542	39 501	...	...	...	...
Silverado (Stewart)	N. Benkovitch, Stewart	22	Crude ore	201	22 647	53	509	332	...
Tasu (Tasu Sound)	Falconbridge Nickel Mines Ltd. (Wesfrob Mines Div.)	1 031 909	Iron concentrates 533 313 t; copper concentrates 11 773 t.	62 207	2 346 969	2 394 377	...	...	...
Slocan Mining Division									
B.N.A. (Kaslo)	Kayawats Mining	22	Crude ore	11	13 034	...	354	707	...
Colonial (Sandon)	Totem Industries	1	Crude ore	...	995	...	282	70	...
Dardenelles (Slocan)	Arley Mines Ltd.	26	Crude ore	5	3 090	...	...	...	...
Hall (Sandon)	Hallmac Mines Ltd.	728	Crude ore	...	1 600 616	...	255 771	...	...
Hecla (Silverton)	Mills and Mengler, Silverton	74	Crude ore	45	92 266	...	483	43 318	391
J.R.F. (Jansen Creek)	J. Elmer, Kaslo	13	Crude ore	22	13 617	...	5 379	...	...
Jumbo (Silverton)	S. Berisoff, Silverton	28	Crude ore	375	6 414	...	1 090	225	...
Ottawa (Springer Creek)	Memphis Mines Ltd.	180	Crude ore	...	278 221	...	489	340	...
Robert E. Lee (Sandon)	Bayshore Resources	22	Clean-up	...	5 412	...	605	...	...

Silmonac, Silvana, Minniehaha (Slocan Lake)	Dickenson Mines Ltd	27 671	Lead concentrates 1 968 t; zinc concentrates 1 109 t	....	11 059 618	....	1 092 290	813 878	4 139
Snowstorm (Slocan)	T. Eccles, Rossland	2	Crude ore	....	2 768	....	390	279	....
Tillicum (Nakusp)	Welcome North Mines Ltd	58	Crude ore	4 539	3 267	....	330	863	10
Tiny Tim (Little Tim Creek)	J. Nabor, Slocan	8	Crude ore	10	29 373	26	383	207	....
Utica (12 Mile Creek)	David Minerals Ltd	147	Clean-up	....	327 737	....	6 765	24 120	....
Victor (Sandon)	E. Peterson, New Denver	16	Crude ore	118	86 250	....	4 025	4 318	....
Victor (Sandon)	I. T. Steenhoff, New Denver	15	Crude ore	9	28 807	....	7 514	1 544	....
Trail Creek Mining Division									
Golden Drip	Lloyd McLellan, Rossland	9	Crude ore	736	1 290	....	149	19	....
Vancouver Mining Division									
Warman (Northair) (Callaghan Creek)	Northair Mines Ltd	62 452	Lead concentrates 1 247 t; zinc concentrates 2 061 t; dore bars	480 555	1 498 670	67 302	620 196	11 189 914	....
Vernon Mining Division									
Black Beard (Silver Bell) (Lumby)	Shertam Industries	12	Crude ore	192	55 371	....	910	437	....
Victoria Mining Division									
Nil	....	....	....	....	....	....	....	....	....

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[1] Estimated.

[2] Prior year adjustment.

Table 3-13A—Destination of British Columbia Ore and Concentrates, 1981

Destination	Ore	Gold[1]/ Silver/Copper Concentrates	Copper[2] Concentrates	Lead Concentrates	Zinc Concentrates	Iron Concentrates	Molybdenite Concentrates, Molybdic Trioxide, Ferro-Molybdenum	Tin Concentrates
CANADA	t	t	t	t	t	t	t	t
Trail	2 679	1 077	....	140 206	150 335	....	1 830	....
Other Canadian	....	....	130 086	....	....	91 912[3]	....	....
FOREIGN								
Australia	....	....	....	....	....	63 768	109	....
Belgium	....	....	....	....	....	....	437	....
Chile	....	....	....	....	....	....	55	....
Czechoslovakia	....	....	....	....	....	....	82	....
France	....	....	....	....	....	....	3	....
Germany	....	....	38 004	....	....	....	1 339	....
Japan	....	....	689 931	....	....	443 729	5 355	....
Korea	....	....	59 263	....	....	....	....	....
Mexico	....	....	....	....	....	....	....	387
Netherlands	....	....	....	....	....	....	1 120	....
Romania	....	....	7 080	....	....	....	....	....
Spain	....	....	7 204	....	....	....	....	....
Taiwan	....	....	31 251	....	....	....	....	....
U.K.	....	906	16 421	....	....	....	847	....
U.S.A.	....	....	....	....	965	2 863	2 757	....
Europe (country not specified)	....	14 326	....	....	....	....	9 425	....
Not specified	....	....	56 413	....	....	....	3 961	....
Totals	2 679	16 309	1 035 653	140 206	151 300	602 272	27 320	387

[1] Includes 200 t jig concentrates and 857 t bulk concentrates.
[2] Includes blister copper.
[3] Includes small amount of coarse iron.

Table 3-13B—Destination of Metals in Ores and Concentrates Shipped from British Columbia Mines—1981
(Showing Metals Paid for and Values)

Country	Gold		Silver		Copper		Lead	
	g	$	g	$	kg	$	kg	$
Canadian Shipments	2 413 771	40 966 752	162 859 560	61 603 753	33 956 867	70 896 035	84 854 093	61 529 276
Foreign Shipments								
Australia	......	......	......	......	......	......	......	......
Belgium	257 350	5 504 458	......	......	......	......	......	......
Chile	......	......	......	......	......	......	......	......
Czechoslovakia	......	......	......	......	......	......	......	......
France	......	......	......	......	......	......	......	......
Germany	91 507	1 201 440	685 523	156 798	11 381 128	24 012 664	......	......
Japan	2 968 019	51 940 778	129 441 579	51 047 154	182 564 591	385 126 165	......	......
Korea	21 250	341 000	2 682 402	1 113 100	15 600 120	34 116 131	......	......
Mexico	......	......	......	......	......	......	......	......
Netherlands	......	......	......	......	......	......	......	......
Romania	7 060	76 195	462 384	175 368	2 196 309	4 532 200	......	......
Spain	52 098	751 687	346 897	84 948	2 092 782	4 145 778	......	......
Taiwan	193 650	3 821 020	1 372 471	680 293	7 355 680	15 683 983	......	......
U.K.	1 068 218	20 399 979	5 884 500	1 984 359	16 197 047	32 855 873	......	......
U.S.A.	140 215	2 117 878	1 919 520	1 000 571	519 856	727 798	......	......
Europe (not specified)	255 631	4 421 235	93 815 426	33 175 673	2 061 196	4 634 369	......	......
Other (not specified)	......	......	4 284 535	1 398 699	16 162 665	34 551 054		
Total Foreign	5 054 998	90 575 670	240 895 237	90 816 963	256 131 374	540 386 015		
Total Shipments	7 468 769	131 542 422	403 754 797	152 420 716	290 088 241	611 282 050	84 854 093	61 529 276

Table 3-13B—Destination of Metals in Ores and Concentrates Shipped from British Columbia Mines—1981
(Showing Metals Paid for and Values)

Country	Zinc		Cadmium		Iron		Molybdenum		Tin	
	kg	$	kg	$	t	$	kg	$	kg	$
Canadian Shipments	78 807 395	66 452 352	100 451	352 613	91 912	2 722 939	861 991	20 486 607	....	....
Foreign Shipments										
Australia	....	....	....	....	63 768	2 199 703	40 201	1 096 992	....	....
Belgium	....	....	....	....	....	....	188 419	3 953 617	....	....
Chile	....	....	....	....	....	....	13 588	237 816	....	....
Czechoslovakia	....	....	....	....	....	....	36 838	507 297	....	....
France	....	....	....	....	....	....	5 869	84 549	....	....
Germany	....	....	....	....	....	....	630 693	9 246 954	....	....
Japan	....	....	....	....	443 729	9 255 182	2 528 209	52 608 061	....	....
Korea	....	....	....	....	....	....	....	....	....	....
Mexico	....	....	....	....	....	....	....	....	150 341	2 198 138
Netherlands	....	....	....	....	....	....	548 929	1 210 181	....	....
Romania	....	....	....	....	....	....	....	....	....	....
Spain	....	....	....	....	....	....	....	....	....	....
Taiwan	....	....	....	....	....	....	....	....	....	....
U.K.	....	....	....	....	....	....	389 165	6 716 367	....	....
U.S.A.	407 157	574 183	1 511	18 464	2 863	96 674	1 358 060	17 750 252	....	....
Europe (not specified)	....	....	....	....	....	....	4 458 795	48 083 724	....	....
Other (not specified)	....	....	....	....	....	....	1 872 467	36 257 974	....	....
Total Foreign	407 157	574 183	1 511	18 464	510 360	11 551 559	12 071 233	177 753 784	150 341	2 198 138
Total Shipments	79 214 552	67 026 535	101 962	371 077	602 272	14 274 498	12 933 224	198 240 391	150 341	2 198 138

Table 3-14—Petroleum and Natural Gas, 1954–1981

Year	Crude Oil		Field Condensate		Plant Condensate		Natural Gas to Pipeline		Butane		Propane		Total Value
	m^3	$	m^3	$	m^3	$	10^3m^3	$	m^3	$	m^3	$	
1954	......	......	......	......	......	......	1 715	6 545	......	......	......	......	6 545
1955	93	480	......	......	......	......	4 752	18 130	......	......	......	......	18 610
1956	23 602	299 322	......	......	......	......	5 292	20 143	......	......	......	......	319 465
1957	54 901	763 751	......	......	4 449	no value	233 138	433 830	......	......	......	......	1 197 581
1958	81 675	1 009 609	......	......	39 915	380 072	1 635 204	3 368 327	12 980	26 115	10 985	22 110	4 806 233
1959	137 484	1 573 227	......	......	81 554	367 797	1 817 945	3 928 839	32 916	66 249	15 410	31 016	5 967 128
1960	137 981	1 531 049	......	......	119 377	459 741	2 257 170	7 101 949	46 643	93 878	19 888	40 029	9 226 646
1961	161 462	1 900 104	25	297	129 349	737 761	2 703 776	8 818 891	51 148	102 946	25 928	52 185	11 612 184
1962	1 415 772	16 827 118	1 530	18 184	133 206	674 644	3 062 513	10 226 323	61 618	124 019	34 500	69 438	27 939 726
1963	1 989 747	24 900 381	2 174	27 205	133 828	536 193	2 973 071	10 719 298	65 041	130 908	32 619	65 651	36 379 636
1964	1 832 404	23 396 716	4 192	63 436	146 622	587 685	3 351 574	12 192 816	73 415	147 763	38 921	78 337	36 466 753
1965	2 141 679	28 696 841	5 053	67 696	150 632	576 106	3 910 948	14 493 255	75 996	152 956	57 042	114 808	44 101 662
1966	2 645 259	36 268 683	6 291	86 265	154 946	312 360	4 543 460	17 339 587	79 650	160 311	53 153	106 981	54 274 187
1967	3 125 181	44 748 477	6 450	92 357	161 541	267 941	5 596 092	21 667 136	93 505	188 197	65 672	132 178	67 096 286
1968	3 521 783	50 082 837	8 611	122 408	152 670	247 455	6 317 544	24 531 445	83 870	168 814	63 723	128 256	75 281 215
1969	4 023 815	58 176 213	12 425	180 520	150 104	263 278	7 218 831	27 897 585	66 385	133 613	52 069	104 800	86 756 009
1970	4 032 130	60 405 941	17 052	277 829	159 489	253 009	7 678 940	29 804 411	49 074	98 772	66 828	134 505	90 974 467
1971	3 999 185	66 471 856	17 331	287 781	177 137	293 287	7 685 055	31 946 372	50 590	101 822	74 547	150 040	99 251 158
1972	3 788 849	63 166 717	16 619	277 069	161 854	327 820	9 939 498	41 616 824	54 200	106 533	76 323	150 015	105 644 978
1973	3 368 902	68 306 032	20 114	407 807	180 088	222 463	10 789 269	54 762 105	109 057	212 640	99 188	193 398	124 104 445
1974	3 012 501	103 335 328	16 561	568 075	178 534	924 549	9 016 996	128 018 726	105 426	232 085	89 373	196 742	233 275 505
1975	2 269 898	94 229 725	16 094	668 092	185 272	6 525 837	9 236 489	214 733 528	106 427	2 577 205	81 975	1 985 087	320 719 474
1976	2 367 450	116 595 050	18 309	901 711	167 576	7 198 957	8 799 508	287 997 059	109 781	4 591 832	88 195	3 688 955	420 973 564
1977	2 200 303	132 859 085	24 465	1 477 248	180 267	9 751 058	8 895 663	396 601 354	111 357	5 358 167	91 297	4 392 944	550 439 856
1978	2 004 699	145 005 524	25 386	1 836 217	155 503	10 269 861	8 003 029	401 373 236	106 580	5 932 766	85 732	4 513 447	568 931 051
1979	2 139 963	168 928 671	32 549	2 569 418	184 398	13 396 500	11 392 641	699 508 127	112 683	7 122 711	84 864	4 851 698	896 377 125
1980	2 002 128	189 561 479	36 855	3 489 431	133 601	11 641 991	8 931 833	612 545 107	89 556	6 491 914	75 507	4 572 704	828 302 626
1981	2 035 953	236 170 548	27 871	3 233 036	124 946	13 284 259	8 062 681	616 795 096	84 635	9 953 076	64 118	5 080 069	884 516 084
Totals	54 514 799	1 735 210 764	315 957	16 652 082	3 546 858	79 500 624	154 065 227	3 678 466 044	1 832 533	44 275 292	1 447 857	30 855 393	5 584 960 199